

Teaching Guide for



INTRODUCTION

The Purpose of This "Teaching Guide"

It is important to remember that Our Number Workshop 2 is designed to give the child an opportunity to apply number ideas and to get experience in using these ideas. Two things must be done before the child can be expected to do the work on the worksheets: (1) the child must be taught the concepts and ideas to be used, and (2) the child must be fully instructed on the procedures required for responding to the exercises.

If Our Number Workshop 2 is used in connection with Numbers in Action, no further teaching of the number concepts is necessary. The teacher need only make certain that all the children understand exactly what they are to do on each worksheet and how they are to make their responses. On each worksheet a brief statement is given of the concepts involved, of the method of presenting the exercise, and of the response required.

For the convenience of teachers using Our Number Workshop 2 without Numbers in Action, this Teaching Guide gives specific instructions for teaching the concepts the children will need before they attempt to do the exercises in Our Number Workshop 2. For each section of worksheets (for example, 17-28, "The Group of 7"), a brief statement of the concepts involved is given under the heading "Objectives"; general suggestions for teaching are given under "Preliminary Teaching"; and detailed instructions for each page are given under "Comments." Also included for each worksheet are brief notes for teaching, and a reproduction of the page, to which the notes are keyed. Answers and various markings the children are

(Continued on page 128)

Teaching Guide for

2



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1-9 GENERAL REVIEW

Objectives

All of arithmetic is based upon a few simple fundamental ideas with which the children must become familiar early. These elementary ideas include (1) one-to-one correspondence, (2) the concept of a group of objects and the number associated with the group, and (3) the concept of order or position in a series.

There are also certain basic abilities that the children must acquire early. These are: the ability to recognize immediately, without counting, groups of 2, 3, and 4 objects, and to recognize all the other groups of from 5 to 10 objects that these subgroups can be combined to make; the ability to count; the ability to read number words and numerals; and the ability to use number words and numerals not only to indicate quantity and position, but also in connection with money.

All of these ideas were introduced and developed in Our Number Workshop 1. They are reviewed on Worksheets 1-9 of Our Number Workshop 2.

Preliminary Teaching

Before using Worksheets 1-9, the children should be able to match, or pair, the objects in one group to the objects in another group (one-to-one correspondence); they should be able to match two objects in one group to one object in another group (two-to-one correspondence); they should be able to recognize, without counting, groups of 2, 3, and 4 objects; they should be able to recognize, without counting, groups of 5 to 10 objects, and know the subgroups into which these groups can be separated; they should know the positional meanings of the numbers to 10; they should know the equivalence values of pen-

nies, nickels, and dimes, and be able to count money made up of combinations of these coins. All of these ideas were taught and developed in Our Number Workshop 1.

To begin the work, hold up a bunch of pencils (or other small objects) and ask, "Are there enough pencils for each child in the class to have one? How can we find out?" The children should suggest giving a pencil to each member of the class, and then they should state whether there are enough, *not enough*, or *more than enough* pencils. Let them find out if there are enough books on a shelf for each child to have one, enough sheets of paper in a pile for each child to have one, etc. Let them discuss other situations in which they might use a matching procedure to determine the number of objects needed, such as laying a place at the table for each person in the family, buying a ticket for each of a group at the movies, etc. Continue similar activities until you are sure the children understand what is meant by *enough*, *not enough*, and *more than enough*, and are able to make these judgments by pairing.

[Worksheet 1 can be used at this point.]

Repeat the pairing activities used before the work on Worksheet 1 was done, but this time have the children make a two-to-one correspondence. For example, let them find out if there are enough straws in a box to put two in each of several paper cups, enough toy cars on a table to put two into each of several toy garages, etc. Be sure that in each case the children state whether there are just enough, not enough, or more than enough objects.

[Worksheet 2 can be used at this point.]

Next, the children should review the work of recognizing groups of 2,

3, and 4. Cards showing groups of 2, 3, and 4 objects may be held up before the class. Have the children, one at a time, respond by saying the group names as rapidly as they can. Be sure they do not have time to count. The pictures may be drawn, stamped, or pasted on 4" x 6" cards in both organized and unorganized groups. If Arithmetic Readiness Cards Set 1: Grouping* is available, the cards showing groups of 2, 3, and 4 can be used.

Since markers will be used throughout the year, it is advisable to accumulate a good supply of them. The work will be more interesting for the children if the markers they use are attractive and varied. Objects such as pebbles, corks, buttons, small plastic disks, and shell macaroni make excellent markers.

For each lesson in which markers will be used in teaching, the number of markers each child will need will be suggested. You may wish to give each child a handful and then collect the extra ones when the children have arranged the groups, or you may find it easier to give each child the required number.

When the children have had some practice in recognizing groups of 2, 3, and 4, have them review the forming of these groups. Give each child 15 or 20 markers. Ask the children to arrange the objects first in groups of 2, then in groups of 3, then in groups of 4, and finally in groups of 2, 3, and 4. Tell them to try to arrange the groups of 2, 3, and 4 so that no objects are left over. The children should learn to do this without counting.

[Worksheet 3 can be used at this point.]

Next, the children should review groups of 6, 8, and 10. They should

*Arithmetic Readiness Cards Set 1: Grouping, by Maurice L. Hartung, Henry Van Engen, and Helen Palmer. Scott, Foresman and Company.

recognize, without counting, the sub-groups that make up these groups. Emphasize that these groups can be made up of two equal groups or of groups of 2, and that each can be separated into two equal groups or into groups of 2.

Use cards showing organized and unorganized groups of 6, 8, and 10, like those suggested for the groups of 2, 3, and 4, or use rather large markers to make groups on a table where they can easily be seen by all the children. Have the children take turns in telling how many objects are in each group. Encourage the children to do this as quickly as possible.

After some practice in recognizing groups of 6, 8, and 10, give each child 20 or 30 markers. Tell the children to arrange groups of 6, 8, and 10 on their desks without counting. Be sure that they make a group of 6 by joining a group of 2 to a group of 4; that they make a group of 8 by joining a group of 2 to a group of 6; and that they make a group of 10 by joining a group of 2 to a group of 8. They should also form groups of 6, 8, and 10 by combining two equal groups. Then have them separate these groups into two equal groups and into groups of 2.

[Worksheet 4 can be used at this point.]

Give the children practice in quickly recognizing groups of 5, 7, and 9 without counting, either by using sight cards or by showing them groups of objects arranged on a table. Emphasize that these groups can be formed by joining a single object to a group of 4, a group of 6, and a group of 8, and that they cannot be made by combining two equal groups. Emphasize also that they cannot be separated into two equal groups or into groups of 2.

Let the children practice making groups of 5, 7, and 9 objects. They

should learn to do this without counting the objects.

[Worksheet 5 can be used at this point.]

Before doing any teaching for Worksheet 6, it is wise to determine the degree to which the children can read number words and symbols and write number symbols. They should be able to read the number symbols 1, 2, 3, . . . to 10 without difficulty. Most of the children also will be able to write the symbols with reasonable ease. If any of them have difficulty in writing the symbols, give special attention to developing this skill during the regular writing lesson. Follow whatever writing procedures are in use in your school. The number words *six*, *seven*, *eight*, *nine*, and *ten* in written form may be new to some of the children. All of the ten number words may be new to some of the children. All new words should be introduced and taught according to the procedures followed in the regular reading program. A complete list of the words used in Our Number Workshop 2 is given on page 129 of this Teaching Guide.

After the number words have been introduced, carry out some activities to help the children relate the number words to the symbols. These activities can also be used to develop the positional meanings of the numbers 1 to 10. Provide two sets of markers for each child in the group. One set should show the number symbols 1 to 10; the other set should show the number words one to ten. The markers in the two sets should be alike in color, shape, and size, so that the children must read the word or symbol in order to select a marker.

First, review the positional meanings of the numbers 1 to 5. Start by placing five objects, such as books, in a row in front of the class. As you put them down, say, "One, two, three,

four, five." Then say: "What number goes with this book? [Point to the first book.] What number goes with this book? [Point to the last book.] Jane, find the middle book. What number goes with it? What number goes with the book between Book 1 and Book 3? What number goes with the book between Book 3 and Book 5? Jack, count off the books by starting at this end. [Point to the right.] Now find the middle book. What number goes with it? Find Book 4. Is it still next to Book 3? What number goes with the book on the other side of Book 4?"

Have the children select the markers that show the numerals 1 to 5 and arrange them in sequence, going from left to right, from right to left, from top to bottom, and from bottom to top. Continue to emphasize that 1 and 5 are at the ends of this sequence, 3 is in the middle, 2 is between 1 and 3, and 4 is between 3 and 5. When the children learn these relationships, they will be able to put the series in order quickly and correctly, going in any direction.

Next, tell the children to select the markers showing the number words one to five. Have them arrange the markers in sequence from left to right, right to left, etc., as they did the markers with the number symbols. Have them match the proper number symbol marker to each word marker.

When the children can identify and match the number words and the number symbols from 1 to 5 and understand the positional relationships of these numbers, teach the sequence 6 to 10. Place a group of five books or blocks on a table in front of the room, and have the children count them off. Then put down five more books, one by one, saying, "six, seven, eight, nine, ten." Be sure to leave extra space between the two groups of 5. Then, pointing to

Book 6, ask, "What number goes with this book?" Point to Book 10 and ask, "What number goes with this book? What number goes with the book that is in the middle?" Emphasize the positional relationships—that 6 and 10 are at the ends of the group, 8 is in the middle, 7 is between 6 and 8, and 9 is between 8 and 10. Also relate these positions to the positions in the series 1 to 5—that 1 and 6 are at the beginning of their groups, 5 and 10 at the end, and 3 and 8 in the middle; and that when the starting point is reversed, 1 becomes 10, 5 becomes 6, 3 becomes 8, etc.

To give the children further practice on the positional meaning of the numbers 6 to 10 and on the number words six to ten, use the number word markers six to ten and the number symbol markers 6 to 10 in the same activities as those used for the series 1 to 5.

[Worksheet 6 can be used at this point.]

Next, the children should continue to review recognition of groups and learn to identify each of them with the appropriate number symbol. *Arithmetic Readiness Cards Set 1: Grouping* may be used in this connection also. If these cards are not available, pictures of groups of objects can be drawn, pasted, or stamped on cards or pieces of oaktag. Hold the cards up one by one and have the children respond by selecting and holding up the marker with the number symbol that corresponds to the number of objects in the group. Or give 10 markers, such as small stones, to each child; then hold up a card showing a number symbol, and let the children make a group of that size. This activity should be used with small groups of children so that you can see the groups the children make.

[Worksheets 7 and 8 can be used at this point.]

In the following activities it is desirable to use real coins if possible. Toy money is a poor substitute because it gives the child no experience with the physical properties of coins—their feel, size, and appearance. Each child should have a dime, two nickels, and ten pennies. Perhaps some of the children will be able to bring the money from home. Each child will need a set of markers with the numerals 1 to 9 and 0 written on them. He will also need one or two markers with the cent sign (¢) written on them.

Let the children talk about the money they have to spend and what they spend it for. Show them a nickel, a dime, and a penny, and be sure they can identify the coins. Explain to them that the words "cent" and "penny" are interchangeable. Explain further that one dime is worth ten pennies or two nickels, and a nickel is worth five pennies. Have the children count ten pennies and put them in a pile beside a dime. Tell them that a dime can also be called "ten cents" because it is worth ten pennies. Then have them put two nickels in a pile beside the dime. Explain again that a dime, two nickels, or ten cents are equivalent in value. Then have the children count five pennies and put them in a pile beside a nickel. Tell them that since a nickel is worth five pennies, it may be called "five cents." Have them put the nickel and the five pennies together in a pile beside the dime and explain that, since five pennies are worth a nickel and two nickels are worth a dime, a nickel and five pennies are also worth a dime. Give the children experience in counting amounts of money up to 10¢. Be sure that when they are counting an amount made up of a nickel and pennies they always count the nickel first, saying, for example, "Five, six, seven cents." Have the children count

out coins on their desks as you call out amounts. Have them arrange their numbered markers to show the amounts. Be sure they always put a marker having a cent sign after the marker that shows the amount.

[Worksheet 9 can be used at this point.]

1

Comments

On this page the children review one-to-one correspondence, or pairing the members of two groups. They evaluate the results and use the appropriate response marks—● for more, too many, more than enough, etc., and ○ for fewer, too few, not enough, etc.

To introduce Worksheet 1, let the children talk about some of the things they do at a playground. Tell them that you are going to draw stick figures to represent boys at a playground. Draw 5 stick figures on the chalkboard. Draw 7 tops under the stick figures. [Be sure the tops and stick figures are not lined up.] Have one of the children put a mark on a top for each stick figure. Have another child cross off the remaining tops. Ask if there are too many or too few tops for each boy to have one.

Now erase the 7 tops and draw 2 tops. Also make a response space like those shown on Worksheet 1. Ask a child to pair the tops and the boys by drawing a line from each top to a boy. Then ask if there are too many or too few tops for the boys. Show the children how to make the mark ○ for too few in the response space.

Children who have used *Our Number Workshop 1* will be familiar with the response marks ● and ○. If any children in the class are not familiar with these marks, make them on the chalkboard at this time. Explain that ● is used to show more, too many, more than enough, etc., and that its

meaning is suggested by the effort needed to make it. The mark O is used to show fewer, not enough, etc., because it is open and requires less effort to make. If necessary, let the children practice making the marks.

Before starting on Worksheet 1, make sure that the children understand how to use markers to pair objects. Point out that the number of boy stick figures in the small pictures is the same as the number of boys in the large picture. Also point out that the number of girl stick figures is the same as the number of girls in the large picture. If necessary, let the children use markers to make a one-to-one correspondence. [Have the children place markers on the boys (or girls) in the large picture and move the markers to the stick figures in each small picture.]

Next, the children are to pair the members of a set of objects in the large picture with objects of the same kind in the first small picture [the swings]. Again, markers may be used, or, if the children prefer, they may make little marks on the objects as they match them. When the children have done this, the swings that have no markers (or marks) on them should be crossed off.

Now the children make a one-to-one correspondence between the swings that have not been crossed off and the stick figures by drawing a line from a swing to a stick figure. They decide that there are fewer swings than boys and make the correct response mark [O] in the red response space. This procedure should be adapted for each small picture.

It will be necessary to work with the children to get them started on each of the procedures outlined above. When they have finished, let them discuss and correct their own work. You may need to work through the entire page with the slow learners.

2 Comments

On this page the children review two-to-one and one-to-two correspondence.

Introduce this page by asking the children if they have ever taken a lunch to a playground or to a picnic. Let them talk about picnic lunches and what they might play on at a playground. Discuss the fact that two children ride on one teeter-totter and that two children might play with one ball. Then bring out that one child might eat two sandwiches or two apples and that he would need two skates if he wanted to roller-skate.

On the chalkboard draw 6 stick figures and 8 or 10 teeter-totters. Draw a ring around 2 children, and then draw a line from the ring to one of the teeter-totters. Explain what this shows [that two children play on each teeter-totter]. Do this for all of the stick figures, and cross out the extra teeter-totters. Draw 6 more stick figures and 14 or 16 apples. Draw a ring around 2 apples, and draw a line from the ring to one stick figure. Explain what this shows [that each child gets 2 apples]. Cross out the extra apples.

Now let the children discuss Worksheet 2. Direct attention to the strips of pictures. Tell them that the stick figures represent 6 children who came to a playground to play with the red objects shown and to eat a picnic lunch. Explain that, for each strip, they should decide whether 2 children would use one of the red objects [a teeter-totter, a sailboat, a ball] or whether one child would use 2 of the red objects [apples, sandwiches, roller skates]. Then follow the directions as outlined in the keyed notes on page 9 of this Teaching Guide.

First have the children make a one-to-one correspondence between the teeter-totters in the big picture at the

left and the red teeter-totters in the first strip at the right, and cross out the extra red teeter-totters. Then they are to decide, for each strip, whether the correspondence should be that of 2 stick figures to one red object or of one stick figure to 2 red objects. They show the correspondence by encircling 2 stick figures and drawing a line to one object or encircling 2 objects and drawing a line to one stick figure.

With some children, it may be advisable to complete the first correspondence (that of objects in the large picture with like objects in the small pictures) for all the strips before beginning the second. With a bright or average group, it will be necessary to work through only two or three of the strips to decide whether the strips should show one child for 2 objects or 2 children for one object. These children can then finish the page independently.

If you correct and evaluate the work, it will be necessary for you to look at each child's worksheet, since the pages can be marked correctly in different ways. There will be no need to check the work done by a slow group, since you will observe and help them while they work through at least four of the strips.

3 Comments

On this page the children review the recognition of groups of 2, 3, and 4 without counting.

Introduce this page by having a child drop about a dozen jacks (or some other even number of jacks) at random on a large sheet of paper. (Wrapping paper may be used.) Ask the children to see the jacks in groups of 2, and let various children point out groups of 2 jacks. Let a child draw rings around groups of 2 jacks. Be sure he does not change the position

of the jacks. If he has trouble including all the jacks, let him plan the groups again.

Increase the number of jacks to 15, and tell the children that this time they are to see groups of 3. Using a fresh sheet of paper each time, have various children draw rings around groups of 3 jacks. Get the children to plan the groups before they draw the rings.

Increase the number of jacks to 16, and have the children plan and encircle groups of 4.

Have the children open their books to Worksheet 3, and explain what they are to do. They are to encircle groups of 2 in the two pictures of jacks; groups of 3 in the two pictures of tops; groups of 4 in the two pictures of balls; and groups of 2, 3, and 4 in the two pictures of blocks. Give directions for each pair of pictures, and have the children complete the work for those two pictures before you give directions for the next pair. Remind the children that when they encircle a group of objects, the objects in that group should be close together. Warn them to plan the groups before they encircle them, so that in each picture every object is included in a group. Warn them also that no object may be used more than once.

An average or bright group should be able to do the work on this page independently if they are given separate instructions for each pair of pictures. A slow group will need help and supervision.

Since there are many different ways of grouping the objects in the pictures, each page will have to be checked individually. Perhaps some children can check their own work.

4 Comments

On this page the children review the groups of 6, 8, and 10 by recognition of their subgroups.

Introduce the page by giving each child a small piece of paper (about 3" x 5") and about 12 markers. Tell the children to pretend that the paper is a pond and the markers are ducks. Have them arrange their markers in groups around the pond. Be sure that the markers in each group are close together and the groups of markers are a reasonable distance from each other. If necessary, draw a picture of a pond on the board and put groups of X's around it to represent the markers.

Now tell the children that just 6 of the ducks are going into the pond. Look at the groups of markers the children have arranged to be sure that each child has a set of subgroups that will make 6. Have each child decide which groups he wants to put in the pond. Be sure to explain that entire groups must be used, and no more than 6 are to be put into the pond. Let the children show you which groups they have decided to put in the pond. Finally, have the children put their groups of markers in the pond. Repeat this activity several times, and ask the children to use a different arrangement of groups of markers each time.

Now tell the children that they are to put just 8 ducks into the pond. Have them make a new arrangement of groups of markers and decide which groups they are going to use to show 8 ducks in the pond. Let them put the ducks into the pond. Inspect what they have done to be sure it is correct. Repeat this activity several times.

Tell the children they are to put 10 ducks into the pond. Have them rearrange their markers again. Work with the children until you are sure they can combine subgroups to make groups of 10.

Ask the children to open their books to Worksheet 4. Point out that in each picture in the first vertical strip they

are to combine subgroups to make groups of 6. In the second vertical strip, they are to combine subgroups to make groups of 8. In the third vertical strip, they are to combine subgroups to make groups of 10. Give directions for one strip at a time. Let the children complete the work for a strip before you give them directions for the next strip.

The children select the groups they are going to combine to make a group of 6 or 8 or 10, draw a ring around each of those groups, and draw a line from the rings to the red object in the center of the picture. Be sure they understand that they must use whole groups of objects. Point out that sometimes they may use a single object if it is by itself in the picture.

The techniques suggested above can be used for an average or bright group of pupils. With a slow group, you should adapt these suggestions so that each activity with markers comes before the work with the strip of pictures to which it applies. Check the work of a slow group for each set of exercises before going on to the next strip of pictures.

Since several correct responses are possible for each picture on Worksheet 4, allow the children to compare and discuss their own work. Such discussion and evaluation will give them more experience in combining subgroups to make groups of 6, 8, and 10.

5 Comments

On this page the children review the groups of 5, 7, and 9 by recognition of their subgroups.

This page may be introduced in the manner suggested for Worksheet 4. Give each child about 12 markers and a small card or piece of paper. Tell the children to pretend that the card is a market basket and the mark-

ers are carrots. Have them arrange their markers in groups around the card. If necessary, demonstrate on the chalkboard how to arrange the groups by making a ring to represent a market basket and X's to represent carrots.

Tell the children they are to put 5 carrots in the basket. Remind them that they must use entire groups, but that they can use a single marker if it is alone. Look at the groups of markers the children have arranged to be sure each child has a set of subgroups of 5 among them. Then have the children show which groups they have decided to put in the basket. The children should repeat this activity several times, using different arrangements of groups of markers.

Using the procedure suggested above, have the children rearrange the markers and combine groups to make a group of 7. Then have them make groups of 9. Do not hurry with this part of the work. The more practice the children get in combining groups by using markers, the better their understanding will be of the addition basic facts.

This page is like Worksheet 4, except that the children make groups of 5, 7, and 9. When they have completed the activities with markers, have them open their books to Worksheet 5. Give directions for one vertical strip at a time. Let the children complete the work for a strip before you give them directions for the next strip. The response technique is the same as that used for Worksheet 4.

6 Comments

On this page the children review the positional meaning of the numbers 1 to 10. They also review the symbols for the numbers 1 to 10 and practice recognition of the number words one to ten.

Number words and numerals appear on this page for the first time in this book. Since the pupils may have encountered some of the number words already, it would be wise to find out which of these number words are included in your school's reading program. The number words that the children are least familiar with are obviously those that must receive the most attention.

In the work with this page, use the ordinal number words *first, second, third, fourth, and fifth* orally, and encourage their use by the children.

Introduce this page by reviewing the numerals 1 to 10 and the number words one to ten. For this purpose you may use sight cards, write number words and numerals on the board, or provide markers that show number words and numerals.

Line up 10 toys on a table where they can be seen easily. Leave some extra space between the two groups of 5. Nine of the toys should be exactly alike, and one should be different from the others (for example, 9 red cars, and one blue car, or 9 cubes and one rectangular prism). Be sure that all the children know the directions *left* and *right*. Ask the children what number goes with the "different" toy, starting at the left. [Point to the left.] Change the position of the toy and ask what number goes with it now. Repeat this activity several times. Then write the number words and the symbols on the board. Ask a child to tell what number goes with the odd toy, and have another child point to the proper numeral and number word on the board. Continue this activity until you are sure the children can identify any position in the series 1 to 10, starting at the left, and can recognize the number words and symbols.

Now line up the toys again and repeat the activity suggested above,

but this time have the children identify positions starting at the right. Continue until you are sure the children can identify any position in the 1 to 10 series.

Now have the children open their books to Worksheet 6. Give directions for using the page as indicated in the keyed notes on page 11.

This worksheet can be checked by using a transparent overlay showing the correct responses. Make the overlay by clipping a piece of transparent tissue or tracing paper over the page in your Workshop after you have made rings around the correct responses; then trace these numerals and number words. The tracings on the overlay can be compared with each child's worksheet very quickly.

7 Comments

On this page the children continue to review recognition of the numerals 1 to 10. They associate each numeral with a group of objects.

To introduce this page, give each child about 10 small objects for markers. On the chalkboard write the numerals 1 to 10 in random order. Tell the children to arrange markers in three groups of 3, and to push aside any markers that are left over. Ask them how many markers there are in all in the three groups of 3. Have one of the children find and point to the numeral 9 on the board. Continue in this way until you have reviewed the combinations of subgroups that make the groups 1 to 10.

Ask the children to open their books to Worksheet 7. Tell them that for each picture they are to decide, without counting, how many objects are in each group and encircle the numeral that indicates the correct number. Work with them as they do the first exercise or two; then let them finish the page independently.

With a slow group, it may be necessary to work through the first two rows of exercises. Be sure to let them get some independent practice, even if they do not finish all the exercises on the page.

A tissue overlay, like the one described for use with page 6, may be used to check this worksheet.

8

Comments

On this page the children review the idea of using two numbers to locate position.

On page 6 the children reviewed the positional meanings of 1 to 10. They were reminded that the positional relationships in the series 1 to 10 are the same whether the series is counted off from left to right, right to left, bottom to top, or top to bottom. Now they use two numbers to locate a position within a region that is marked off, both horizontally and vertically, like a checkerboard.

Introduce this page by using a large sheet of wrapping paper that you have prepared in this way: Fold it in fourths, and draw heavy lines on the folds. Divide each quarter into 25 "boxes." Refold the sheet of paper so that only the top left quarter can be seen. Hold it up so that all the children can see it, and explain what you mean by rows and "boxes." Let a child count off the rows, starting at the top. Let another child count them off, starting at the bottom. Let two children count off the boxes, one starting at the left, and the other starting at the right. Unfold the sheet so that the left half is visible. Have the children count off rows and boxes again, starting at the top, the bottom, the left, and the right. Get the children to observe that there are 10 rows, but only 5 columns of boxes. They should observe the heavy black line between rows 5 and 6.

Now open the sheet completely and fasten it in a place where all the children can see it. Have the children count off the rows and boxes, and get them to observe the 10 columns of boxes and the heavy black line between the fifth and sixth columns.

Now, using the sheet, show the children how to locate a box. First, write the numerals 4 and 2 on the board and draw a square around the 2 (see the key on page 9). Tell the children that the first numeral gives the number of the row they are to find, and the second numeral gives the number of the box in that row. Count off the row, starting at the top; then count off the box, starting at the left. Make an X in it.

Have several children locate rows and boxes, starting at the top and left. They might make X's or draw apples or balls in the boxes. When you are sure the children understand how to locate rows and boxes from the top and left, have them locate rows and boxes from the bottom and left. Continue by having them locate rows and boxes starting at the top and right and the bottom and right.

Worksheet 8 is divided into horizontal rows that may be counted off from top to bottom or from bottom to top. The rows are divided by vertical lines into columns of boxes that may be counted off from left to right or from right to left. The heavy black line between the fifth and sixth rows and between the fifth and sixth columns of boxes will help the children in locating rows and boxes. The red toys printed on the page will serve this purpose also. The red truck is in Row 1, Box 1, starting at the top and left, but it is in Row 10, Box 10, starting at the bottom and right. Before the children begin drawing the objects on Worksheet 8, let them practice locating the five red toys from various starting points.

The objects to be located and drawn by the children are in the two columns on the left side of Worksheet 9. They are to draw each of these objects in the row and box indicated by the two numerals beside the object. The first numeral gives the number of the row, and the numeral in the square tells the number of the box in that row. For example, the first item of the black column tells the children to draw a picture of a balloon in Row 4, Box 2. First the children draw the objects listed in the black column in boxes located by counting off from the top and left. Then they use this key column again and draw the same objects, but this time they count off from the bottom and left. The red key column may be used in four ways: starting at the top and left; the top and right; the bottom and left; and the bottom and right. The children should use a different color of crayon for each set of drawings. If the children use the colors suggested in Note 3 on page 12 of this Teaching Guide, the work of checking the accuracy of the location of their drawings will be greatly facilitated.

Although Worksheet 8 and the keys on Worksheet 9 may be used to locate boxes in six ways, no group of children should be expected to do all of them. A slow group will do well to complete the first exercise with reasonable accuracy. An average or bright group should complete three of the exercises. The remaining exercises may be used as optional work for bright children, or you may come back to this worksheet later in the year to strengthen the children's understanding of how to use two numbers to locate a position.

In evaluating the children's work, no emphasis should be placed on the quality of the drawing. Any drawing that is identifiable as the correct symbol is acceptable.

For checking Worksheet 8, make an overlay by clipping a sheet of transparent paper over the worksheet and tracing the heavy black lines that divide the page in fourths, as well as the other horizontal and vertical lines. Using the reproduction of Worksheet 8 on page 12 of this Teaching Guide, write on the overlay in each box the name of the object and the color, as shown. When the overlay is prepared in this way, each child's worksheet can be checked easily.

9 Comments

On this page the children review the identification of nickels, dimes, and cents, or "pennies," and also the cent sign. They also review counting amounts of money up to 10 cents.

To introduce this page, put a few pennies, nickels, and dimes on a

table or desk where the children can see them. Ask various children to point out a dime, a penny, a nickel, two nickels, five pennies, etc. Continue this activity until you are sure every child can identify these coins. Then have the children count out coins that make up various amounts of money up to ten cents—7¢, 2¢, 9¢, etc. When it is possible, have them show more than one selection of coins for each amount.

Write the cent sign on the board, and ask the children what it means. Then write 8¢, 3¢, 7¢, etc. Ask the children what they could buy with each amount of money and what coins they could use.

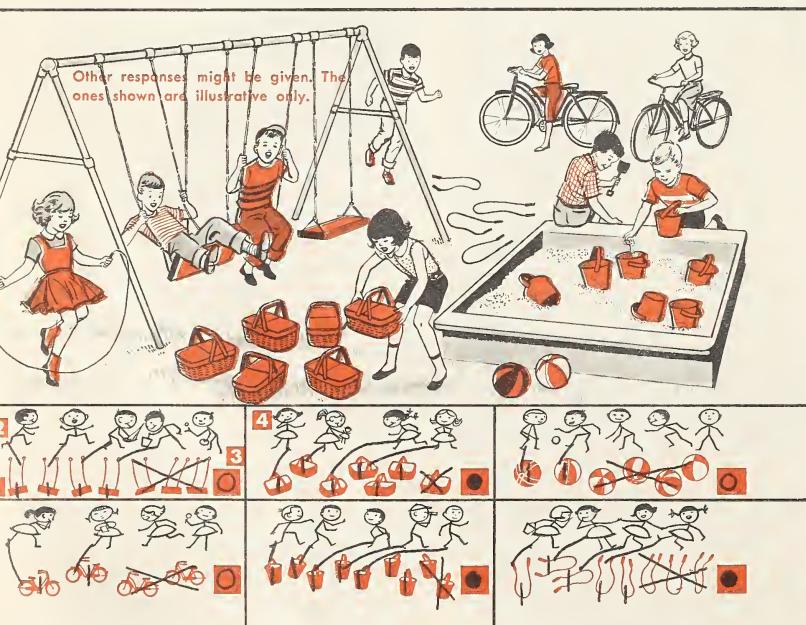
Have the children open their books to Worksheet 9. Have a child tell the prices of the different toys. If you are working with a bright group of children, ask them to tell what they think

they are to do. Then, after demonstrating on the board, tell them to draw a ring around the coins they would use to buy the toy in each picture. The remaining coins may be crossed off.

With an average group, you may need to work through only the first exercise or two. A slow group will need more help. You will probably have to work with them while they do half of the exercises. Encourage them to do at least a few independently.

When the children have completed the exercises on Worksheet 9, let them compare and discuss their work. If you prefer to do the evaluating, it will be necessary to look at each page individually, since several correct responses are possible for each picture.

1



1 Give each child 7 markers. Tell the children to put a marker on each swing in the big picture, then move the markers, one by one, to the red swings in the first small picture. Have them cross out all the swings that have no markers on them.

2 Tell the children to draw a line from each stick figure to a red swing that is not crossed off, until all the stick figures or all the swings have been used.

3 Tell the children to make the mark ● in the red response space if there are more swings than boys. If there are fewer swings than boys, they are to make the mark O.

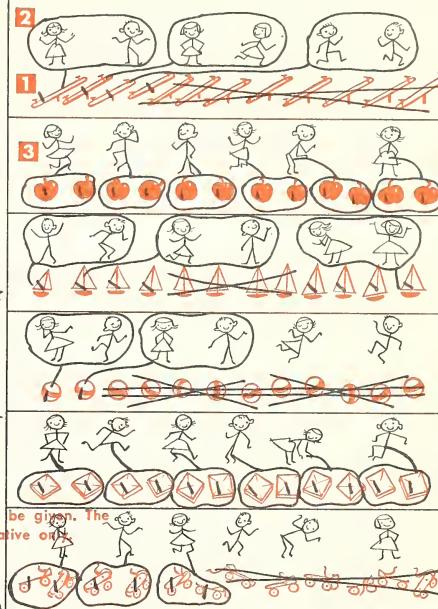
4 Adapt this procedure for each small picture.

2

1 Give each child 12 markers. Ask the children to put a marker on each teeter-totter in the big picture at the left, then to move the markers, one by one, to the red teeter-totters in the top strip at the right. Then they should cross out all the teeter-totters that have no markers on them.

2 Tell the children to decide whether to put 2 stick figures with one teeter-totter or 2 teeter-totters with one stick figure. Then they should draw a ring around 2 stick figures and draw a line from the ring to one teeter-totter. They should continue to do this until all the stick figures or all the teeter-totters have been used.

3 Adapt this procedure for each strip of pictures.



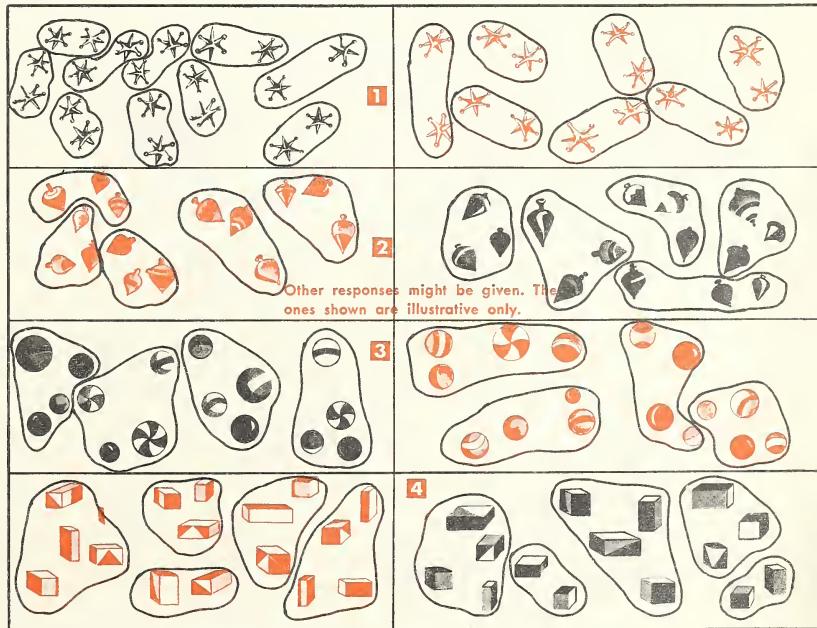
3

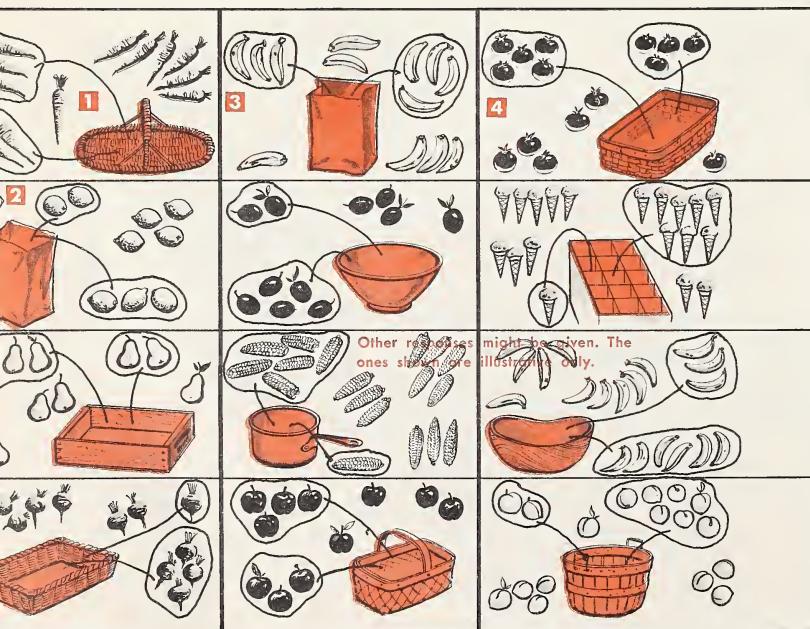
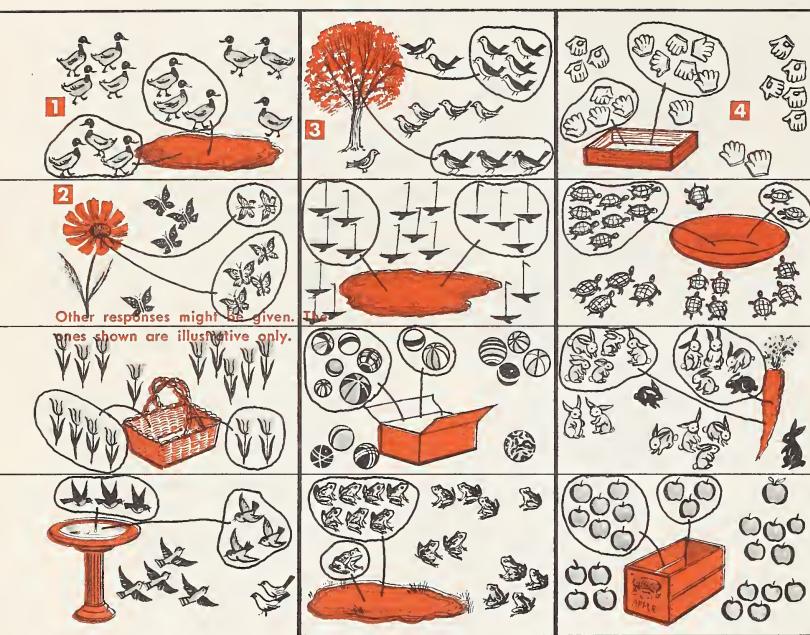
1 Direct attention to the two pictures of jacks. Tell the children to draw rings around groups of 2 jacks each. In each picture, all the jacks must be used, and each jack may be used in only one group. Remind the children to plan all the groups before they draw the rings. Let them complete this work.

2 Direct attention to the two pictures of tops. Tell the children to encircle groups of 3. Adapt the instructions in Note 1.

3 Direct attention to the two pictures of balls. Tell the children to encircle groups of 4. Adapt the instructions in Note 1.

4 Direct attention to the two pictures of blocks. Tell the children to encircle groups of 2, 3, and 4. Adapt the instructions in Note 1. Be sure they encircle groups of 2, of 3, and of 4 in each picture of blocks.





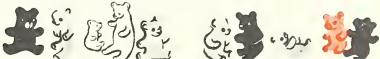
6

1 Direct attention to the top picture [toy cars]. Ask the children what number indicates the position of the red car, starting at the left. Then have them find the proper numeral for it among the black numerals at the left and encircle it.

2 For each of the other pictures, have the children decide what number indicates the red object, starting at the left, and encircle the proper black number word or numeral.

3 Call attention to the first picture again. Have the children decide what number indicates the red object, starting at the right, and encircle the proper red number word.

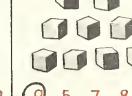
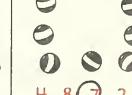
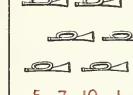
4 For each of the other pictures, have the children decide what number indicates the red object, starting at the right, and encircle the red numeral or number word.

| | | | |
|---|---|--|--|
| 7 6 2 5 5 | 8 10 3 9 1 | 1  | 3 six four ten one three |
| one ten four two six | nine five eight three seven | 2  | 4  |
| 2 10 4 7 5 | 9 1 8 3 6 | | 5 8 9 1 7 10 |
| three eight ten one seven | five nine six four two |  | 6 8 4 1 3 7 |
| 6 3 7 4 | 1 10 2 5 8 |  | 7 four six one five three |

7

1 Let the children examine and discuss the page. Then direct attention to the first picture. Ask the children to decide, without counting, how many cars there are. They should then find the appropriate numeral among the red numerals below the cars and encircle it. Examine their work to see that they are responding correctly.

2 Have the children encircle the proper numeral for each of the other pictures on the page.

| | | | | |
|--|--|--|---|--|
| 1  7 1 4 9 6 10 3 2 5 8 | 2  4 9 6 1 7 3 8 5 2 10 |  5 9 10 4 1 9 6 2 8 7 |  8 5 9 6 2 1 7 10 4 3 |  9 5 7 8 1 2 10 4 6 3 |
|  6 10 8 3 9 4 7 5 2 1 |  7 3 4 9 1 2 10 8 5 6 |  10 1 8 7 5 3 6 9 2 4 |  3 5 10 8 2 1 7 9 4 6 |  4 8 7 2 6 5 1 10 9 3 |
|  6 1 10 4 3 2 9 7 5 |  9 2 8 5 7 1 10 4 6 3 |  5 7 10 1 3 4 6 9 2 8 |  1 6 2 8 4 5 10 3 7 9 |  9 4 8 3 10 5 2 7 6 1 |
|  6 1 3 8 10 4 2 5 9 7 |  8 2 7 5 6 1 4 10 3 9 |  2 5 9 4 1 6 3 7 10 9 |  9 5 3 8 10 1 7 6 2 4 |  5 1 2 7 9 6 4 10 3 8 |

| | | | | | | | | | |
|--------------|---------------|---------------|-------------|--------------|---------------|-------------|----------------|------------|--------------|
| | yellow sun | blue balloon | red pail | green broom | blue broom | black chair | green balloon | brown sun | |
| green glass | black sun | black glass | blue moon | brown flower | yellow flower | green moon | red boat | red cone | blue glass |
| blue apple | black flag | green chair | yellow boat | brown flag | yellow flag | brown boat | blue chair | red ball | green apple |
| black kite | black balloon | brown ball | red broom | green cone | blue cone | black apple | yellow ball | black moon | black flower |
| | green kite | brown pail | brown tree | | | yellow tree | yellow pail | blue kite | black tree |
| | yellow kite | blue pail | blue tree | | | green tree | green pail | brown kite | red tree |
| red kite | red balloon | blue ball | black broom | yellow cone | brown cone | red apple | green ball | red moon | red flower |
| brown apple | red flag | yellow chair | green boat | blue flag | green flag | blue boat | brown chair | black ball | yellow apple |
| yellow glass | red sun | red glass | brown moon | blue flower | green flower | yellow moon | black boat | black cone | brown glass |
| | green sun | brown balloon | black pail | yellow broom | brown broom | red chair | yellow balloon | blue sun | |

1 Tell the children to draw the pictures specified in the black column of numerals and pictures on Worksheet 9 (a balloon in Row 4, Box 2) in the correct boxes. Have them start at the top and left and use black crayon or pencil.

2 Have the children draw the pictures specified in the black column again, this time locating the boxes by starting at the bottom and left and using red crayon.

3 The pictures indicated in the red column on page 9 may be drawn in blue, starting at the top and left; in green, starting at the top and right; in brown, starting at the bottom and left; and in yellow, starting at the bottom and right. If the children use the colors suggested here, the pictures they draw will correspond with the answers on the reproduced page.

| | | | |
|---|--|--|--|
| 4 2 Q 7 3 ♂ | | | |
| 9 8 ♂ 2 4 C | | | |
| 1 7 H 4 6 ♀ | | | |
| 5 10 ♀ 9 5 ♀ | | | |
| 8 9 ♂ 3 8 L | | | |
| 4 1 ♂ 2 10 □ | | | |
| 10 4 □ 1 3 ♀ | | | |
| 7 4 ♂ 8 7 ♂ | | | |
| 3 2 P 10 9 ♂ | | | |
| 4 7 6 4 ♂ | | | |
| 2 2 ♂ 1 6 ♂ | | | |
| 4 9 C 5 9 ♂ | | | |
| 9 9 9 3 1 ♂ | | | |
| 2 3 □ 6 3 ♂ | | | |
| 4 10 ♀ 8 5 P | | | |
| Other responses might be given. The ones shown are illustrative only. | | | |

1 Direct attention to the first picture. Ask how much the toy car costs. Tell the children to draw a ring around the coins they would use to buy the car. Tell them to cross off the other coins in the picture. Remind them that the coins they encircle should show just enough money to buy the car.

2 Have the children follow the same procedure for each of the other pictures on the page.

10-16 THE GROUP OF 5 AND THE GROUP OF 3

Objectives

One of the major goals in the study of arithmetic is successful problem solving. This is best achieved by presenting arithmetic concepts to the child in an orderly and organized way, and developing them slowly and soundly.

Among the first of the fundamentals to be learned by the child are the concepts of addition and subtraction. Understanding these operations should be inseparably involved with learning the addition and subtraction basic facts. In this arithmetic program, these concepts and facts are taught by means of the group idea. First, the child learns to recognize, without counting, groups of 2, 3, and 4. Then he learns to see various combinations of these groups as groups of 5 to 10, and he comes to understand that two groups are often combined to make a single group. When learning to recognize groups, he moves two groups of real objects together to make one larger group. Then he learns that sometimes two groups may not actually be combined, but that they can be combined mentally, or by imagination. These combining actions, both actual and imagined, lead to the concept called addition. In the next stage, he learns to make and understand statements like "3 dogs plus 2 dogs are 5 dogs" that are associated with the numerosness of two groups, the action of combining, and the numerosness of the resulting group.

In the same way the child learns that a single group may be separated into two subgroups. Again, his first experiences are with real objects. Then he learns that sometimes the groups are not separated by actual movement, but that the action of taking away a part of the original

group may be imagined. These actual and imagined separating actions lead to the concept called subtraction. Next, the child learns to make and understand statements like "5 pigs minus 3 pigs are 2 pigs" that are associated with the numerosness of the original group and of the group taken away, the action of separating, and the numerosness of the resulting group.

In Our Number Workshop 2, all of the addition basic facts whose sums are the same are taught together, by using the group idea. Similarly, all of the subtraction basic facts that arise when a group is separated into two subgroups are taught together. This method organizes both the teaching and the learning of the basic facts in a logical and psychological way, and assures a sound foundation of knowledge that will lead to an understanding of the more complex arithmetic ideas to follow.

The groups are studied in a carefully planned sequence; namely, groups of 5, 3, 7, 6, 8, 4, 9, and 10, in that order. The group of 2 is included, but the two easy facts involved ($1 + 1 = 2$ and $2 - 1 = 1$) do not require special attention. This sequence was chosen to avoid confusion. For example, if the basic facts for the 6 group were presented first, it would be necessary to include some basic multiplication and division ideas, since 6 can be thought of as 2 threes or as 3 twos. The eight addition and subtraction basic facts for the group of 5 are taught before those for the group of 3, so that a good general idea of addition and subtraction may be acquired at the outset. There are only two addition facts ($1 + 2 = 3$ and $2 + 1 = 3$) and two subtraction facts ($3 - 2 = 1$ and $3 - 1 = 2$) for the group of 3.

In Our Number Workshop 2, each set of worksheets devoted to the addition and subtraction basic facts for one of the above groups follows a consistent pattern. First, the addition basic facts for a group are introduced by means of pictures that develop the idea of combining action. Then, the same facts are presented as sentences expressed in words and numerals. These sentences also are accompanied by pictures with which the children associate the sentences. The subtraction basic facts for a group are introduced and symbolized in the same way. For each set of basic facts (and at frequent intervals throughout the book for all facts previously taught) there are several pages of simple problems in both pictorial and symbolic form. Exercises for distinguishing between additive and subtractive actions are provided.

Work with the addition and subtraction basic facts is begun with the group of 5.

Preliminary Teaching

Before using Worksheets 10-16, the children should be able to make groups of 5 by combining groups of 2 and 3, of 3 and 2, of 4 and 1, and of 1 and 4. They should be able to separate a group of 5 into these pairs of subgroups. They should also understand the meaning of the words *plus* and *minus*, be able to read them, and be able to use them in sentences.

To begin the preliminary work for the group of 5, give each child 5 markers. Tell the children to arrange a group of 3 markers and a group of 2 markers on their desks. Tell them to pretend that their markers are puppies, and that the 3 puppies are going to join the 2 puppies. Have them push the 3 markers over to the 2 markers, and ask how many markers there are altogether. Get them to say "2 puppies and 3 puppies are 5 puppies."

Now tell them to arrange their markers in a group of 2 and a group of 3 again. This time they are to push the group of 2 over to the group of 3. Ask how many markers there are in all. Get them to say "3 puppies and 2 puppies are 5 puppies."

Using the same methods, have the children arrange their markers in groups of 4 and 1, and 1 and 4, join one group to the other, and tell what happened. Let the children take turns in making the sentences.

All phrases and words that express the idea of combining should be used orally during this part of the work. Among these words and phrases are "joining," "coming together," "coming to meet," "altogether," and "in all." When the idea of combining groups is clear to the children, introduce the word *plus*. Explain what it means, and encourage the children to use it. When they say "4 ducks and 1 duck are 5 ducks," ask them to say it again using *plus* in place of "and." At this time the word *plus* is to be used orally only.

Let the children make and combine groups with their markers until they are familiar with the four ways in which two groups can be combined to make 5. Have them take turns in making sentences using *plus*.

[Worksheet 10 can be used at this point.]

Next, make sure the children can read and understand such sentences as "3 dogs and 2 dogs are 5 dogs" and "4 dogs plus 1 dog are 5 dogs." Since this type of sentence was used orally in the work with page 10, understanding should present no serious problem. Be sure you use words that are included in the vocabulary of the reading program in your school. The word *plus* is introduced as a reading word at this point. Use the methods you ordinarily use to introduce a new word. Be sure the children can

recognize *plus* and know what it means before they use Worksheet 11.

Now tell the children to pretend their 5 markers are dogs or some other animal whose name they can read. Let them arrange the markers in two groups. Then, after combining the groups, have one of the children give a complete sentence describing what he did ("3 dogs plus 2 dogs are 5 dogs"). Write his sentence on the board. Ask another child to read the sentence aloud. Tell the children to show what the sentence means with their markers. Be sure the sentence is read slowly enough to give the children time to arrange and move their markers. Continue in this way until several sentences have been written on the board. Observe what the children do with their markers, and have them correct their mistakes. Let as many children as possible have a turn in making and in reading a sentence.

You can continue the same type of activity by using cards on each of which you have printed an arithmetic sentence like those above. Use the addition basic facts for the group of 5. Use only the names of objects or animals that the children can read. Use *and* on some cards and *plus* on others. These cards might read as follows: "1 doll plus 4 dolls is 5 dolls," "3 cats and 2 cats are 5 cats," "2 boats and 3 boats are 5 boats," "4 balls plus 1 ball are 5 balls." Let a child select a card and read it aloud, while the rest of the children arrange and move their markers to illustrate the basic fact in the sentence.

[Worksheet 11 can be used at this point.]

In the preliminary work for pages 10 and 11, emphasis was placed on developing the oral vocabulary necessary to express the action of two groups *coming together*. Now it is necessary to emphasize words and expressions that are used to express

the action of separating one group from a larger group. Typical words and phrases are *went away from*, *flew away*, *ran away*, *took away*, etc. When the idea of taking away is clear, introduce the word *minus*. The children should arrive at the generalization that this word is used to describe what happens mathematically when a subgroup is removed from a group. The word *minus* is to be used orally only at this point.

Give each child 5 markers. Remember that to develop generalizations, it is important to use various kinds of small objects, if at all possible. Ask the children to arrange the markers in a group of 5 on their desks. Say something like this: "Let's pretend that the markers are birds in a tree. How many birds are in the tree? Now let's pretend that 3 of the birds flew away. Move 3 markers away. How many birds are left? If 3 birds fly away from 5 birds, how many birds are left? 5 birds minus 3 birds are how many birds?"

Have the children move groups of 2, 4, and 1 away from a group of 5 in the same way. Make the activity as interesting as possible by making up a different story to describe the action each time. Pretend the markers are kittens, ducks, airplanes, cars, or whatever the children suggest.

Next, have the children work independently with the markers and take away from the group of 5 as many different groups as they can. Explain that each time they take a group away, they are first to see how many are left. Then they are to make up a sentence that tells how many were in the original group [5], how many they took away, and how many are left.

[Worksheet 12 can be used at this time.]

Before starting Worksheet 13, introduce *minus* as a reading word.

Use the methods used in your reading program, and be sure the children can recognize the word and know what it means. Make sure they can read and understand such sentences as "5 rabbits minus 4 rabbits are 1 rabbit." In the activities outlined below, use only words that are included in the vocabulary of the reading program in use in your school.

Give each child 5 markers. Tell the children to arrange the markers in a group on their desks, and to pretend the markers are chickens that are being fed. Have a child show with his markers that 3 of the chickens are running away. Let him move a group of 3 markers away. Ask how many chickens are left. Then ask him to make a sentence that tells what happened. If he says something like "5 chickens were eating and 3 chickens ran away; then 2 chickens were left," ask him to tell the same thing in a shorter way, using the word *minus*. When he says "5 chickens minus 3 chickens are 2 chickens," write the sentence on the board. Ask one of the children to read the sentence aloud. Tell the other children to show what it means with their markers. Be sure the sentence is read slowly so the other children will have time to arrange and move their markers.

Continue in this way until you have on the board at least one sentence for each of the subtraction basic facts for the group of 5. The nouns in the sentences should be varied, so that you can be sure the children are really reading, not just looking at the numerals. Then point to sentences in random order, and ask various children to read them, while the others move their markers to show what the sentences mean. Observe what the children do with their markers, and have them correct their mistakes.

The same type of activity may be continued by using cards on which

you have printed sentences like those on the board. You should have about 20 cards. Use the name of a different animal, object, or toy on each. Let a child pick a card and read it aloud, while the rest of the children arrange and move their markers to illustrate the basic fact.

[Worksheet 13 can be used at this point.]

The children next learn to discriminate between the action that suggests addition and the action that suggests subtraction, and at the same time they practice the addition and subtraction basic facts for the group of 5.

Ask five children to stand in a group at one side of the room. Direct one child to leave the group and stand at the other side of the room. Ask the rest of the class to tell you what happened. They will probably start by saying something like: "John, Mary, Sue, David, and Joe were standing over by the window; then David walked away and stood over by the cupboard." Discuss the situation with them until you get them to say "5 children minus 1 child are 4 children." Be sure to bring out that the word *minus* is used because the action is going away.

Now ask two children to stand at one side of the room and three children at the other, and direct the two children to join the three children. Get the children to see that this time the action is coming together, or joining, and thus we say "3 children plus 2 children are 5 children."

Next, write on the board eight sentences that express in words and numerals the eight addition and subtraction basic facts for the group of 5. Have the children use their markers to show that they can read and understand the sentences. Take plenty of time with this part of the work, so that you can be sure the children can

distinguish between addition and subtraction.

[Worksheets 14 and 15 can be used at this point.]

To present the four addition and subtraction basic facts for the group of 3, you may use activities similar to those suggested for the group of 5. Since the four basic facts for the group of 3 ($2 + 1 = 3$, $1 + 2 = 3$, $3 - 1 = 2$, $3 - 2 = 1$) are simple, the children are probably already familiar with them. A relatively brief period of preliminary work should be sufficient.

[Worksheet 16 can be used at this point.]

10 Comments

On this page the children study the addition basic facts for the group of 5.

On this page the response marks X and \cancel{X} (called the "scribble" mark) are used in Our Number Workshop 2 for the first time. X is used to indicate yes, this one, here, etc. \cancel{X} is used to indicate no, not this, etc. Children who have used Our Number Workshop 1 will be familiar with these marks, but they should be reminded of what the marks mean and how to use them before they do the work on page 10. The children who did not use Our Number Workshop 1 must be taught the meaning and use of the marks.

Ask the children if they have ever heard the phrase "X marks the spot" and what they think it means. Get them to understand that an X is often used to mean here or this one. Make an X on the board, to be sure the children know what it looks like. Let them practice making X's on a piece of paper. Then draw a few simple objects on the board (apple, box, tree), and direct various children to make X's under certain objects.

Next, ask the children if they have ever scribbled over something they have drawn. Make the mark , and explain that they are going to use the scribble mark to mean no, not this one, etc. Let the children practice making the scribble mark on a piece of paper.

Introduce this page by giving each child 5 markers. Give such directions as: "Put 3 markers on one side of your desk and 2 markers on the other side. Now push the 3 markers over to the 2 markers. How many markers do you have in all?" Work with the markers until the children have demonstrated all the addition basic facts for the group of 5 several times. Have the children open their books to Worksheet 10, and give them directions for the page.

The red key strip at the left of page 10 shows the action of one group joining another for each of the addition basic facts for the group of 5. From the four pictures at the right of each red picture, the children are to select those pictures that correctly show the result of the action illustrated in the red picture. In the red response space in each white picture the children are to make a mark that tells whether or not the picture shows the correct number of animals. If the picture shows a group of 5, the children are to make an X in the space. If it does not show a group of 5, they are to make a scribble mark ().

An able or average group should do the work on this page independently after you have worked with them through the first two pictures in the first row. A slow group may need to use markers with at least part of the page, and possibly with all of it. Tell these children to put a marker on each animal in the red picture, then move the markers one by one to the dogs in the first white picture. Get the children to tell which response mark

they should make in the red space. Work in this way with the children until they can continue by themselves, or until they finish the page.

This page may be checked by using a transparent overlay showing the correct response for each picture. When you make the overlay, be sure to trace the heavy black line that separates the red pictures from the rest of the page and also the top horizontal line. These lines will help you to position the overlay on the pupil's page. Make your response marks on the overlay to the left of the red response spaces so that they will not cover the child's marks.

11 Comments

On this page the children are introduced to written statements of the addition basic facts for the 5 group. This involves reading with understanding such sentences as "3 dogs plus 2 dogs are 5 dogs."

The action of two groups combining to make a group of 5 and the completed action were shown on page 10. On page 11 the pictures show one group of animals moving toward another group, but the completed action is not shown. The sentences given symbolize the numerosness of the groups, the action, and the numerosness of the group resulting from the action. The child reads a sentence, finds a picture that illustrates the sentence, and writes in a red response space the letter of the sentence.

To introduce this page, give each child 5 markers and quickly review the four addition basic facts for the group of 5. Then write on the chalkboard several sentences like those on page 11. Have one child read a sentence, while the other children move their markers to show what it means. Make sure they understand that in a

sentence like "3 dogs and 2 dogs are 5 dogs," 3 dogs are joined by 2 dogs.

When you are sure the children can read and understand such sentences and know which group is joining the other group, ask them to open their books to page 11. Explain that there are two sentences for each picture on the page. For each sentence they are to find a picture that illustrates it and then write the letter of the sentence in one of the response spaces in the picture.

Average or bright children will be able to do the work on this page by themselves after you have worked with them on one or two sentences. A slow group may need to use markers to work out the action before they can match the sentence to a picture. Be sure these children understand that in each sentence the group mentioned first is being joined by the other group.

This page can be checked by using a transparent overlay showing the correct responses. When you make the overlay, trace as a guide the two vertical lines that separate the pictures from the sentences. Write your responses above the red response spaces.

12 Comments

On this page the children study the subtraction basic facts for the group of 5.

Introduce the page by giving each child a handful of markers. Each child is then to make a group of 5. (Collect the extra markers.) Give such directions as: "Pretend your markers are birds sitting on a fence. How many birds are sitting on the fence? Three of the birds are going to fly away. Push three of the markers away. How many birds are left sitting on the fence? How many birds were there to start? How many birds flew

away? How many birds are left?" Continue with similar directions and questions until the children have worked out all the subtraction basic facts for the group of 5 at least twice.

When you are sure the children understand the action that suggests subtraction, begin to use the word *minus* orally. Before the children do the exercises on Worksheet 12, they should be making statements like: "5 birds minus 3 birds are 2 birds."

Worksheet 12 is like Worksheet 10, except that it deals with the subtraction basic facts. Have the children open their books to page 12, and let them tell what they think they should do with the key picture and the first two white pictures in the top row. If they do not remember, help them. If necessary, review the response marks X and ~~Z~~.

An average or bright group will have no trouble doing the work on this page independently. A slow group may need to use markers to work out the exercises. Use the techniques suggested in "Comments" for page 10.

This page may be checked by using a transparent overlay like that suggested for Worksheet 10.

13 Comments

On this page the children are introduced to written statements of the subtraction basic facts for the group of 5. This involves reading with understanding such sentences as "5 dogs minus 3 dogs are 2 dogs."

Page 12 showed both the action and the result when a subgroup separated from a group of 5. On page 13 the pictures show a group of animals going away from a group, but the result after the action has been completed is not pictured. The sentences symbolize the numerosness of the original group, the action, the

numerousness of the group going away, and the numerosness of the group that remains. The child is to read a sentence, find a picture that illustrates the sentence, and write the letter of the sentence in the red response space in the picture.

Introduce this page by reviewing quickly the four subtraction basic facts for the group of 5. Have the children work with markers, and emphasize that the action suggests subtraction. Ask various children to make up sentences like those on page 13. Write them on the board. Have the children move their markers to show what each sentence means. If a child gives a sentence that uses a basic fact that has already been given, have him find (on the board) the sentence with the same basic fact in it. This will help the children see that there are only four basic subtraction facts for the group of 5.

Have the children open their books to Worksheet 13. Tell them that for each sentence they are to find the picture that goes with it. An average or bright group will have no trouble doing the work on this page by themselves after you have given them directions. A slow group may need to use markers to work out the action before they can match a picture to the sentence. Work with these children in the way suggested in "Comments" for page 11.

This page can be checked by using a transparent overlay like that suggested for page 11.

14 Comments

On this page the children distinguish between combining and separating actions.

For each picture, the children are to select from the two sentences below the picture the one that expresses what is happening.

To introduce this page, quickly review the addition and subtraction basic facts for the group of 5 with emphasis on discriminating between the action that suggests addition and the action that suggests subtraction. On the board write a sentence that illustrates any one of the addition or subtraction basic facts for the group of 5. Have the children read the sentence and use their markers to show the action. Then have a child read the sentence aloud, and have another child tell whether the action is that of combining or of separating. If necessary, review the four addition and the four subtraction basic facts in this way.

Next, ask the children to open their books to Worksheet 14, and give them directions for the page. Work with them while they do the first two exercises, and be sure they understand that they are to cross out the wrong sentence for each picture.

An average or bright group of children will have no difficulty in doing these exercises as outlined in the keyed notes. A slow group will probably need to use markers to work out the action and the basic fact for each picture. Help these children until they are able to work by themselves. Ask questions and make suggestions that will help them understand what is happening in the pictures. Some children may be able to do half the exercises on the page independently if they use markers, and others may need help with the entire page. Take as much time as necessary, since this page is the first of several similar ones throughout the book.

This page may be checked by using a transparent overlay similar to those suggested for previous pages. Be sure to trace one of the horizontal and one of the vertical lines on the page to use as a guide in placing the overlay. It is advisable to encircle

the correct sentence on the overlay so that you can see clearly whether or not the incorrect sentence is crossed out in the pupil's book.

15 Comments

On this page the children use simple problem situations to practice combining groups to form a group of 5 and separating a subgroup from a group of 5. They encounter, for the first time, the incomplete arithmetic sentence and learn to supply the missing numerals in such sentences.

This page is similar to page 14, except that here the children must not only decide whether the action pictured suggests addition or subtraction and what the basic fact is, but also must complete the sentence that tells what is happening. For the first time in the Workshop they are required to write numerals. Before you begin the work on the page, be sure all the children can write the numerals 1 to 5.

Introduce this page by writing several sentences like those on page 15 on the board. Omit the answer, and use a line to show that it is missing. Point to the first sentence, and ask the children to use markers to show what the sentence says and to find the answer. Ask a child to come to the board and write the answer on the line in the sentence. Repeat this activity until you are sure the children know exactly what to do.

Ask them to open their books to page 15, and let them discuss it for a minute or two. Get them to say what they think they should do with these exercises. If necessary, give them directions and work through the first picture with them.

An average or bright group should have no difficulty with this page. A slow group will probably need to use markers. Work with such children in the way suggested in "Comments"

for page 14 until they are able to work independently.

This page may be checked by using a transparent overlay. Encircle the correct sentence and write the answer after the sentence so that the pupil's answer can be seen plainly.

16 Comments

On this page the children practice the addition and subtraction basic facts for the group of 3 and continue to practice the addition and subtraction basic facts for the group of 5.

The four basic facts for the group of 3 ($2 + 1 = 3$, $1 + 2 = 3$, $3 - 1 = 2$, $3 - 2 = 1$) are so easy that they require very little special attention. Most of the children probably learned them in the first grade, along with learning to recognize groups of 2, 3, and 4. Though they may know these basic facts, it will probably be necessary to help them organize their knowledge. They should think of these basic facts as associated with the group of 3 and realize that the four facts make up all the ways you can put groups together to make a group of 3 and all the ways you can separate a group of 3 into two subgroups. Let the children work with markers to find "all the things they can do with a group of 3."

Pictorial problem situations for both the group of 3 and the group of 5 are presented on page 16 to help the children distinguish between them. Since the pages of pictorial problem situations and practice throughout the book will include addition and subtraction basic facts for many groups, the children must have a systematic approach to solving them. First, they should look at the subgroups of objects or animals in a picture and decide how many there are in all. This will tell them what group they are working with. Then they should decide

whether the action shown is that of bringing groups together or of separating groups. This will tell the children whether the basic fact the picture represents is addition or subtraction, and whether the word *plus* or the word *minus* should be used to express it. Finally, they should decide which group is joining or leaving the other group. Not all children, of course, will need to make each decision separately, and even the children who start out doing so will learn in time to see and comprehend all the ideas at once.

Introduce this page by asking the children to recall what they did on page 15. Then ask them to open the books to page 16 and tell what they think they are going to do. Let them discuss the page for a minute or two and get them to notice that some of the pictures show problems for the group of 3 and some show problems for the group of 5. By giving directions and asking questions, have them go through the three steps outlined above for two or three of the pictures. Then let them do the remaining exercises on the page independently.

All the children should be able to finish this page in one period. The slow learners may need to work on the problem in each picture with markers to find the answer.

This page may be checked by using a transparent overlay like that suggested for page 15.

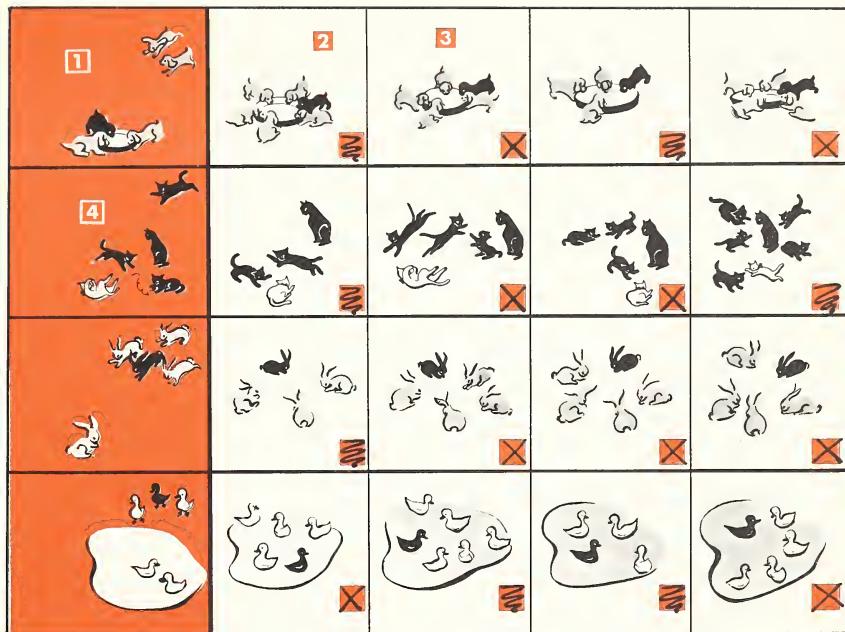
10

Introduce or review the response marks X and . Direct attention to the top red picture. Ask how many dogs are eating and how many are coming to eat. Ask how many dogs will be eating when the 2 dogs join the 3 dogs.

Have the children look at the first white picture in the top row. Ask if it correctly shows the result of what is happening in the red picture (a group of 5 dogs eating). Tell the pupils that if it shows 5 dogs, they are to make an  in the red response space; if it does not, they are to make a scribble mark .

Tell the children to make a mark in the red response space for each of the other white pictures in the top row.

Tell the children to follow the same procedure for the other three rows of pictures on the page.

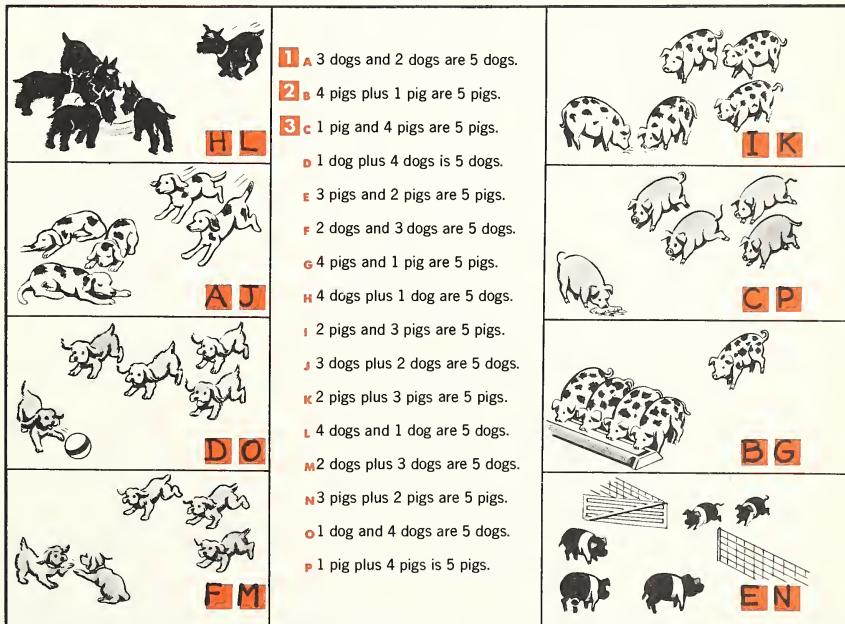


11

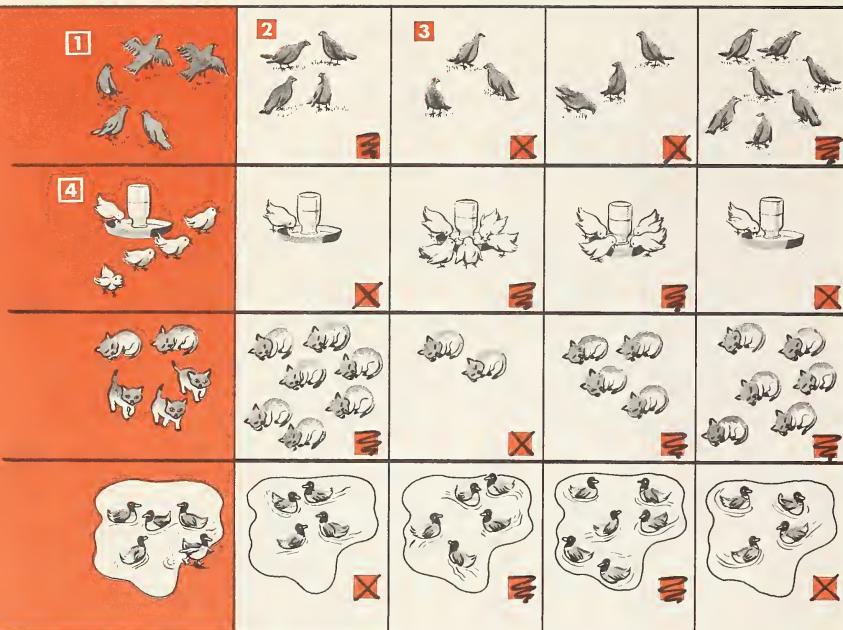
Tell the children that there are two sentences for each picture and that they should write the letter for each sentence in a red response space. Ask the children to read Sentence A, find the picture that it tells about, and write the letter A in one of the response spaces. Have a child explain why the picture he has chosen is the correct one.

Direct attention to Sentence B. Have the children proceed as for Sentence A, and give any help that is necessary.

Have the children find the picture that illustrates each of the remaining sentences.



12



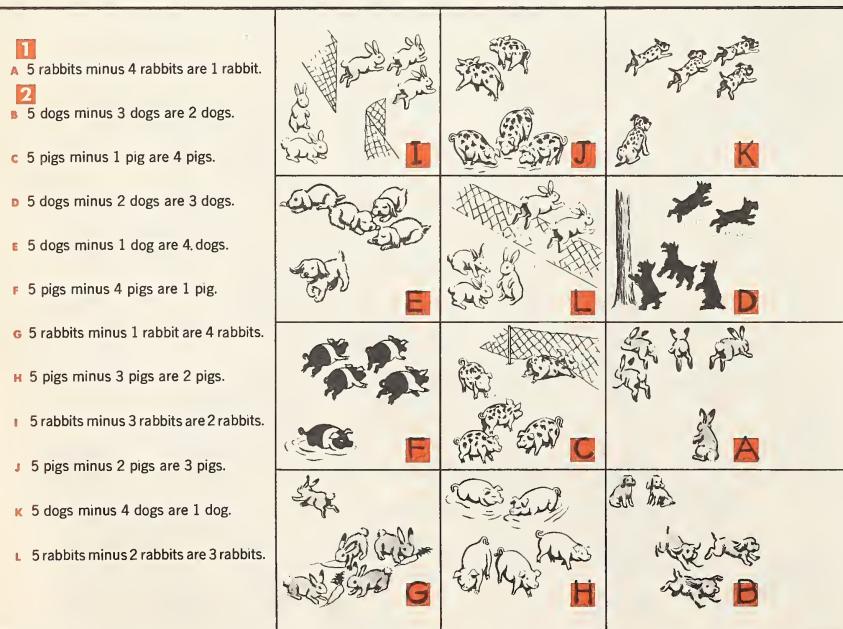
1 Direct attention to the first red picture. Ask how many birds there are in all in the picture, how many are flying away, and how many will be left.

2 Tell the children to look at the first white picture and decide if it shows the number of birds that will be left. If it does, they are to put X in the red response space. If it does not, they are to put ~~X~~ in the space.

3 Have the children make a mark in the red space for each of the other white pictures in the top row.

4 Tell the children to follow the same procedure for the other three rows of pictures on the page.

13



1 Ask the children to read Sentence A, find the picture that it tells about, and write the letter A in the red response space. Have a child explain why the picture he has chosen is the correct one.

2 Have the children find the picture that matches each of the remaining sentences and write the letter of the sentence in the response space.

14

1 Get the children to notice that in some of the pictures on this page a group of animals is joining another group and that in others a group of animals is going away. Direct attention to the first picture. Ask the children how many dogs are eating, and whether the single dog is joining the group or going away from it.

2 Ask the children to read the two sentences below the picture and decide which one tells what is happening. Explain that they should cross out the sentence that is wrong.

3 Have the children follow the same procedure for each of the other pictures on the page.

| | | |
|---|---|---|
| 1 5 dogs minus 1 dog are 4 dogs. 4 dogs plus 1 dog are 5 dogs. | 2 5 rabbits minus 2 rabbits are 3 rabbits. 3 rabbits plus 2 rabbits are 5 rabbits. | 3 5 squirrels minus 3 squirrels are 2 squirrels. 3 squirrels plus 2 squirrels are 5 squirrels. |
| 4 dogs plus 1 dog are 5 dogs. 5 dogs minus 1 dog are 4 dogs. | 3 pigs plus 2 pigs are 5 pigs. 5 pigs minus 2 pigs are 3 pigs. | 5 pigs minus 4 pigs are 1 pig. 1 pig plus 4 pigs is 5 pigs. |
| 5 rabbits minus 3 rabbits are 2 rabbits. 2 rabbits plus 3 rabbits are 5 rabbits. | 2 dogs plus 3 dogs are 5 dogs. 5 dogs minus 3 dogs are 2 dogs. | 1 squirrel plus 4 squirrels is 5 squirrels. 5 squirrels minus 4 squirrels are 1 squirrel. |

15

1 Direct attention to the first picture. Ask the children how many dogs there are in each group and how many there are in all. Then ask them whether a group of dogs is joining another group or whether a group is leaving. Have the children read the two sentences below the picture and decide which one tells what is happening. Have them cross out the incorrect sentence.

2 Ask the children what is missing in the correct sentence. Tell them to write the numeral for the answer on the red line.

3 Have the children follow the same procedure for each of the other pictures on the page.

| | | |
|---|---|---|
| 1 1 dog plus 4 dogs is <u>5</u> dogs. 5 dogs minus 4 dogs are <u>1</u> dog. | 2 5 chickens minus 3 chickens are <u>2</u> chickens. 2 chickens plus 3 chickens are <u>5</u> chickens. | 5 birds minus 3 birds are <u>2</u> birds. 2 birds plus 3 birds are <u>5</u> birds. |
| 1 bird plus 4 birds is <u>5</u> birds. 5 birds minus 4 birds are <u>1</u> bird. | 4 kittens plus 1 kitten are <u>5</u> kittens. 5 kittens minus 1 kitten are <u>4</u> kittens. | 4 chickens plus 1 chicken are <u>5</u> chickens. 5 chickens minus 1 chicken are <u>4</u> chickens. |
| 3 kittens plus 2 kittens are <u>5</u> kittens. 5 kittens minus 2 kittens are <u>3</u> kittens. | 4 birds plus 1 bird are <u>5</u> birds. 5 birds minus 1 bird are <u>4</u> birds. | 3 dogs plus 2 dogs are <u>5</u> dogs. 5 dogs minus 2 dogs are <u>3</u> dogs. |

| | | |
|---|--|---|
|  <p>1</p> <p>2 chickens plus 1 chicken are <u>3</u> chickens.</p> <p>3 chickens minus 1 chicken are <u>2</u> chickens.</p> |  <p>3</p> <p>5 birds plus 2 birds are <u>7</u> birds.</p> <p>5 birds minus 2 birds are <u>3</u> birds.</p> |  <p>5</p> <p>5 dogs minus 3 dogs are <u>2</u> dogs.</p> <p>2 dogs plus 3 dogs are <u>5</u> dogs.</p> |
|  <p>1</p> <p>3 dogs minus 2 dogs are <u>1</u> dog.</p> <p>1 dog plus 2 dogs is <u>3</u> dogs.</p> |  <p>5</p> <p>5 kittens minus 1 kitten are <u>4</u> kittens.</p> <p>4 kittens plus 1 kitten are <u>5</u> kittens.</p> |  <p>2</p> <p>3 birds minus 1 bird are <u>2</u> birds.</p> <p>2 birds plus 1 bird are <u>3</u> birds.</p> |
|  <p>1</p> <p>5 kittens minus 4 kittens are <u>1</u> kitten.</p> <p>1 kitten plus 4 kittens is <u>5</u> kittens.</p> |  <p>1</p> <p>1 rabbit plus 2 rabbits are <u>3</u> rabbits.</p> <p>3 rabbits minus 2 rabbits are <u>1</u> rabbit.</p> |  <p>3</p> <p>3 chickens minus 2 chickens are <u>1</u> chicken.</p> <p>1 chicken plus 2 chickens is <u>3</u> chickens.</p> |

17-28 THE GROUP OF 7

Objectives

The learning of the addition and subtraction basic facts, begun in the previous section with the facts for the group of 5 and the group of 3, is continued with the facts for the group of 7. The organization and development of ideas used to teach the facts for the groups of 5 and 3 are used to teach the group of 7. Emphasis again is placed on the ideas of combining and separating actions. The same pattern is followed throughout Our Number Workshop 2 when the addition and subtraction basic facts for each new group are presented.

The six addition basic facts for the group of 7 are introduced first. The children go through the three familiar stages of learning them: using real action, in which they combine actual

objects to make a group of 7, and looking at pictures that show both the action and the result of the action; using imagined action, in which they combine groups of objects in their minds to find a total; and using symbolization, in which they make and read statements like "4 chickens plus 3 chickens are 7 chickens."

The six subtraction basic facts for the group of 7 are introduced and taught in the same way.

When the children have used markers to illustrate all of the addition and subtraction basic facts for the group of 7 and have had considerable practice in making and reading statements about concrete situations using the words *plus* and *minus*, they should be ready for the next steps toward understanding the symbolization of these basic facts using numerals and the sign "+." In this

1 Direct attention to the first picture. Ask the children to decide how many chickens there are in each group and how many there are in all. Then ask them to decide whether a group of chickens is joining another group or whether a group is leaving. Have the children read the two sentences below the picture and decide which one tells what is happening. Have them cross out the incorrect sentence.

2 Ask the children what is missing in the correct sentence. Tell them to write the numeral for the answer on the red line.

3 Tell the children to follow the same procedure for each of the other pictures on the page.

section of worksheets the children make the transition from "3 pigs plus 2 pigs are 5 pigs" to "3 plus 2 is 5" and finally to "3 + 2 is 5." Similarly, for subtraction, the transition is made from "7 pigs minus 3 pigs are 4 pigs" to "7 minus 3 is 4" and "7 - 3 is 4." The idea that the operations of addition and subtraction can be performed with numbers associated with groups whose numerosness is known without giving attention to physical aspects of the objects that make up these groups is the mathematical generalization the children are required to make. Be sure that from the time the signs + and - are first introduced the children learn to read them *plus* and *minus*.

Preliminary Teaching

Before work is started on Worksheet 17, the children should be able to

make groups of 7 by combining groups of 6 and 1, 1 and 6, 5 and 2, 2 and 5, 4 and 3, and 3 and 4. They should be able to separate a group of 7 into these same pairs of sub-groups. Before doing the work on Worksheet 23, the children must learn to use the symbols + and -.

Since the first pages in Worksheets 17-28 picture items found in grocery stores, let the children talk about experiences they have had in buying things at a grocery store. Then give each child 7 markers. Tell the children to pretend that the markers are cans of fruit. A grocer is putting them on a shelf. Ask them to arrange their markers in two groups. Say: "Mike, how many markers are there in each of your groups? Who else arranged his markers in a group of 3 and a group of 4? Push one group over to the other group. Ella, which group did you push? How many markers are there in all? 4 cans and 3 cans are how many cans?" Explain that there are other ways in which two groups can be combined to make a group of 7 and that pushing a group of 3 over to a group of 4 is just one of the ways. Tell the children that they are going to find the other ways and keep track of how many ways there are by making a tally mark for each one. Put a tally mark on the board.

Now ask: "Who pushed the group of 4 over to the group of 3? How many markers are there in all? 3 cans plus 4 cans are how many cans?" Make another tally mark on the board.

Ask if anyone has arranged his markers in a different pair of groups. Let one of the children tell what groups he has made. Say: "Who else has a group of 6 and a group of 1? All the children who have a group of 6 and a group of 1 should push one of the groups over to the other. Jack, which group did you move?

How many markers are there in all? 6 cans plus 1 can are how many cans?" Make another tally mark.

Then say: "Did anyone move the group of 6 over to the group of 1? How many markers are there in all? 1 can plus 6 cans is how many cans?" Make a tally mark.

Now ask if there is anyone who has not yet combined his two groups of markers. Let these children tell how many markers they have in each group. They should have a group of 2 and a group of 5. Have the children move their groups together. Ask questions like those suggested above for the two remaining ways ($2 + 5$ and $5 + 2$) of grouping to get a group of 7, and make a tally mark on the board for each. Ask one of the children how many ways there are of combining two groups to make a group of 7.

Now tell the children to pretend that their markers are apples. Ask a child to show one way to make a group of 7 by combining two groups. Have him tell the class how he arranged his markers and how he combined them. Ask him to make a sentence that describes what he did. He should use the word plus (for example, "5 apples plus 2 apples are 7 apples").

Ask another child to show another way of making a group of 7. Proceed with this activity until all the addition basic facts for the group of 7 have been demonstrated and sentences made for them. Then let the children continue making groups of 7. Let them work individually or in groups of two or three. Help those who need it.

[Worksheet 17 can be used at this point.]

Next, make sure the children can read and understand such sentences as "5 bottles plus 2 bottles are _____ bottles." Again, see that each child has 7 markers. Tell the children to

pretend the markers are bottles of milk. Have them take turns making up sentences like the one above. Write each sentence on the board, and have the children arrange and move their markers to show what it means. Then let a child complete the sentence orally and write the answer on the blank line. Continue this activity until there is a sentence on the board for each of the addition basic facts for the group of 7. Then have the sentences read in random order, one at a time. For each sentence the children should move their markers to show what it means. Continue this activity until you are sure all the children can read and understand the sentences.

[Worksheet 18 can be used at this point.]

Have on hand 7 small cereal boxes. See that each child has 7 markers. Place the cereal boxes on a table or desk where all the children can see them. Tell them to pretend that they are in a grocery store, and they are going to buy packages of cereal. Say: "How many boxes of cereal are there on the counter? Betty, come to the counter and tell me how many boxes of cereal you are going to buy. Three boxes? Push 3 cereal boxes to the side. [Each child should push a group of 3 markers to the side of his desk.] How many boxes are left? 7 boxes minus 3 boxes are how many boxes?" Continue this activity until all the subtraction basic facts for the group of 7 ($7 - 1 = 6$, $7 - 2 = 5$, $7 - 3 = 4$, $7 - 4 = 3$, $7 - 5 = 2$, $7 - 6 = 1$) have been demonstrated several times.

Now, have the children show all the subtraction basic facts with their markers again. This time record the six facts by making a tally mark on the chalkboard for each one. Explain that a tally mark is made for each way that they can take a group from

a group of 7 and find how many are left.

[Worksheet 19 can be used at this point.]

Review briefly the subtraction basic facts for the group of 7, using markers or objects such as books or boxes.

Next, make sure the children can read and understand sentences like "7 cans minus 1 can are _____ cans." Let them take turns in making up such sentences. Write each sentence on the board, and ask all the children to move a group of markers away from the group of 7 markers. Let them pretend their markers are cans of fruit or boxes of crackers. Ask how many are left. Let a child write the answer in the sentence on the board. Repeat this activity until there is a sentence on the board for each of the subtraction basic facts for the group of 7. Then point to the sentences in random order, and have them read by a child while the other children move their markers. Continue this activity until you are sure all the children understand the sentences.

[Worksheet 20 can be used at this point.]

Place 7 rather large objects, such as books, on a table where all the children can see them. Move a group of books away from the other books, and ask the children which word, plus or minus, the action suggests. Let a child make a sentence that tells what happened. Now combine two groups and ask which word, plus or minus, the action suggests. Continue the activity, mixing addition and subtraction, until most of the facts for the group of 7 have been reviewed.

Next, ask two children to come to the front of the room. Explain that you will say either "plus" or "minus," and one of the children is to move the books to show the action that the word suggests. The other child is then to make a sentence that describes the

action. Vary the number of books so that the children will get practice on the addition and subtraction basic facts for the groups of 3, 5, and 7. Have them take turns until they have reviewed all these basic facts and until you are sure they can distinguish between the action that suggests the word plus and the action that suggests the word minus.

[Worksheets 21 and 22 can be used at this point.]

Now the children are to make the transition from the word plus to the sign +. Provide each child with 7 markers. Write "4 pigs plus" on the board, and ask one of the children to decide how many pigs are going to join the 4 pigs. Accept any number that will lead to a basic fact the children have learned. Tell the children to use their markers to show how many pigs are going to join 4 pigs. Then write "3 pigs are" after the first phrase. Ask a child to tell how many pigs there are in all. Write "7 pigs" next. Then ask: "If we say '4 dogs plus 3 dogs' instead of '4 pigs plus 3 pigs,' what will the answer be? If we say '4 girls plus 3 girls,' what will the answer be? Is 4 of something plus 3 of something always 7? Could we say '4 plus 3 is 7'?" Write "4 plus 3 is 7" on the board.

Follow the same procedure with several other addition basic facts. Work in this way until the children have made the generalization that when a group of known size is combined with another group of known size, the numerosity of the resulting group does not depend upon what concrete objects comprise the group. Explain that when we say "4 + 3 is 7," we add. Use the word add with the children whenever you can do so easily and naturally.

Then say: "There is another way we can write '4 plus 3 is 7.' " Write "4 + 3 is 7" on the board. Point to

the plus sign and explain that it means exactly the same as the word plus, that it is read "plus," and that it is used when one group is being combined with another group. Write "5 + 2 is 7" on the board, and ask the children to move their markers to show what it means. Ask one child to read the statement aloud. Be sure he says "plus" when he reads the plus sign. Repeat this procedure with different addition basic facts for the groups of 3, 5, and 7.

Erase what you have written on the board and write "6 _____ 1 is 7." Ask the children what is missing. Let a child write the plus sign in the space provided for it. Repeat this procedure several times. Let the children practice making the plus sign on paper at their desks or at the board.

[Worksheet 23 can be used at this point.]

To introduce the minus sign, adapt the activities outlined above. Be sure to explain what the word subtract means, and use it in talking to the children whenever you can. Take as much time as is necessary for the children to understand the use of the minus sign and to read it properly.

[Worksheets 24-27 can be used at this point.]

Introduce the words add and subtract as reading words by your usual reading procedures. Then write add and subtract on the board. Put 7 books or other rather large objects on a table where all the children can see them. Move a group of 2 books to one side of the table, and ask a child to read the word suggested by the action you performed. Repeat this type of activity several times, using both combining and separating actions. Let several children have a turn in reading the proper word.

Next, give each child 7 markers. Write on the board "Add 2 and 5." Tell the children to read what you

have written and do what it tells them to do. They should move a group of 5 to a group of 2. Get the children to understand that when they see "Add 2 and 5," they should think "2 + 5 is 7." Write "Add 5 and 2." See that they push a group of 2 over to a group of 5. Use the addition facts in this way until the children can make the correct interpretations.

Now write "Subtract 1 from 4" and observe what the children do with their markers. Get them to see that when they read "Subtract 1 from 4," they should think "4 - 1 is 3." Follow the same procedure for the various subtraction facts. Continue this activity by recalling the facts in random order until you are sure the children can differentiate between the actions that suggest addition and subtraction and can follow directions.

[Worksheet 28 can be used at this point.]

17 Comments

On this page the child looks at a picture of two groups that are about to be combined, and he then selects from four pictures those that show the result when the action has been completed. The addition basic facts for the group of 7 are used.

First, make sure the children have had sufficient practice in combining groups for the addition basic facts for the group of 7, as suggested in "Preliminary Teaching." Then have the children open their books to page 17. Ask them what they think they are to do. If necessary, give them directions. Review the meaning of the marks X and ~~—~~.

An average group should be able to complete the work on this page in one period. Let the slow learners use markers, as suggested in "Comments" for Worksheet 10 (on pages 15-16 of this Teaching Guide).

Page 17 may be checked by using the same type of transparent overlay that was suggested for page 10.

18 Comments

On this page the children complete the action of joining two groups to make a group of 7 by imagining that the groups are combined. They are introduced to the symbolization of the addition basic facts for the group of 7. The sentences symbolize in words and numerals the numerosness of the groups and the action, but the result of the action is not given.

Before the children begin work on page 18, make sure they have had sufficient practice on the addition basic facts for the group of 7 and can read and understand sentences like those on the page. Suggestions are given in "Preliminary Teaching."

The child is to read a sentence, find the picture that illustrates the sentence, and write the letter of the sentence in one of the blue response spaces. He mentally completes the action pictured and completes the sentence by writing the appropriate numeral on the blue line. There are two sentences for each picture.

Pupils in an average or bright group should be able to do the work on this page after you have worked with them on the first picture. The slow learners may need to use markers to work out the action before they match a sentence to a picture. If necessary, ask questions and give directions that will help them find the picture that goes with the sentence. Let the children do at least a few of the exercises on the page by themselves.

This page can be checked by using a transparent overlay like the one suggested in "Comments" for Worksheet 11 (page 16 of this Teaching Guide).

19 Comments

On this page the children study the subtraction basic facts for the group of 7.

To introduce the page, draw on the chalkboard three or four simple pictures to illustrate some of the subtraction basic facts. (Balls rolling off a table, boxes tumbling off a shelf, or anything else equally easy to draw will do.) Label each of these pictures with a letter. Under this first set draw a few more pictures that show the balls, boxes, etc., that remain after the action in the lettered pictures has been completed. Place each of these pictures so that it is not directly under the lettered picture with which it corresponds. Each picture in the second set should have a response space in one corner.

A child should first tell what is happening in a specified picture (Picture A, for example). He should state the total number of objects in the picture and the number that are leaving. He should make it clear that the action suggests subtraction. Another child can tell how many objects will be left, find the picture that shows the number of objects that will be left, and write the letter A in the response space. Give as many children as possible a chance to work with these pictures.

Then have the children open their books to page 19. Tell them to find for each blue picture the white pictures that show the group that remains and write the letter of the blue picture in the blue response spaces.

An average or bright group can complete this page in one period. A slow group may need to use markers to work out the action in the key pictures and find the remainders.

A transparent overlay showing the correct responses can be used to check this page.

20 Comments

On this page the children are introduced to written statements of the subtraction basic facts for the group of 7.

Before the children open their books to page 20, make sure they have had practice with markers and can read and understand sentences like those on the page. Suggestions are given in "Preliminary Teaching."

The child is to read each sentence, find a picture that illustrates the sentence, and write the letter of the sentence in the blue response space. He then mentally completes the action in the picture and completes the sentence by writing the appropriate numeral on the blue line. There is a picture for each sentence.

This page can be checked by using a transparent overlay that shows the correct responses. Write the answers after the sentences and the letters above the response spaces, so that the children's responses will be clearly visible.

21 Comments

On this page the children distinguish between the action that suggests using the word *plus* and the action that suggests using the word *minus*. They practice the addition and subtraction basic facts for the 3, 5, and 7 groups.

Introduce this page by giving each child a handful of markers. Write the words *plus* and *minus* on the board, and draw a line three or four inches long a little to the right and below the words. Then say: "Put a group of 3 markers in the middle of your desks. Now push a group of 2 markers over to the 3 markers. How many markers are there in all? Sue, which word on the board tells what you did with the markers? Go to the board and cross out the other word. Joe, go to the

board and write a numeral on the line that will show us the number of markers there are in the group you just made."

Now erase and rewrite the word that was crossed out, and erase the numeral that was written on the line. Give a new set of directions involving a subtraction fact. Continue this activity until the children understand the procedure.

Have the children open their books to page 21, and let them tell what is happening in the first two pictures. Ask which word—*plus* or *minus*—they should cross off in each picture, and what they should write on each of the blue lines. Be sure they understand that they are to cross off the wrong word and that the numeral they write on the blue line represents the group that is the result of the action in the picture. For addition, this numeral will tell the number of objects in all; for subtraction, it will tell the remainder.

A bright group will be able to do the work independently. Help the slow learners by asking questions and giving directions for at least half of the exercises. They should be able to complete the page independently.

This page may be checked by using a transparent overlay that shows the correct responses.

22 Comments

On this page the children solve simple pictorial problems that involve the addition and subtraction basic facts for the groups of 3, 5, and 7.

Introduce this page by writing on the board six sentences like those on page 22. Half of them should involve addition basic facts and the other half subtraction basic facts. Give each child a handful of markers, and say: "Pretend your markers are boxes [or some other object]. Push 4 boxes over to 3 boxes. Mary, find the sen-

tence on the board that tells what you just did and read it aloud. John, what should you write on the line? Go to the board and write the answer on the line." Continue this activity until the children have performed with markers all the actions indicated by the sentences on the board and have written the correct answer for each sentence. Ask them to open their books, and give them directions for page 22.

A bright or average group should finish the exercises on this page in one period. A slow group may need, and should be given, more practice with the addition and subtraction basic facts. It would be a good idea to hectograph sheets of 10 or 12 sentences like those on page 22 and let these children use markers to work out the answers. Then when they open their books to do the work on the page, point out that the pictures show the same kinds of actions they have just been performing with their markers, and the sentences on the page are like the ones they have just finished. Help them with the first few exercises, and try to get them to match the sentences and pictures without using markers.

Note that there are five sentences without matching pictures. Tell the children that for each of these sentences they are to write just the answer on the blue line.

A transparent overlay may be used to check this page.

23 Comments

On this page the children begin to write the plus sign. They learn that such statements as "4 girls plus 3 girls are 7 girls" can be generalized as " $4 + 3 = 7$." Although they continue to learn new arithmetic facts by observing and manipulating real objects, it is essential that they realize that the arithmetic idea itself does

not depend upon what the application of it may be.

Complete understanding of the abstract nature of the facts and operations of which arithmetic is composed does not come at the end of a single lesson, of course, or at any predictable point during the years the children spend learning arithmetic. It develops slowly, and it must be soundly based.

Do not let the children begin page 23 until you have spent enough time on the activities suggested in "Preliminary Teaching" to be sure the children really understand the ideas those activities are designed to teach. Page 23 is intended to strengthen this understanding.

To introduce this page, write on the chalkboard several sets of sentences like those under the pictures on page 23, with one variation. The first sentence in each set should tell the number of objects or animals in each of the groups that are to be combined. Give each child 7 markers. Have the first sentence in the first set read aloud, and tell the children to use their markers to find the answer. Let a child write the answer on the line. Ask a child to read and complete the second sentence. Have another child read and complete the third sentence. Continue this activity until all the sets of sentences on the board have been completed.

Ask the children to open their books to page 23, and give directions for the exercises within the pictures. When they have finished these exercises, give directions for Exercises A to H at the right of the page.

A transparent overlay may be used to check the children's work.

24 Comments

On this page the children begin to write the minus sign, and learn that

such statements as "3 boys minus 1 boy are 2 boys" can be generalized as "3 - 1 is 2."

This page is like page 23 in purpose and technique, except that it deals with subtraction and the minus sign instead of addition and the plus sign. It, too, is designed to provide practice in using ideas that have been taught in the preliminary teaching.

Introduce the page by writing on the board several sets of sentences like those within the pictures on page 24. Give each child 7 markers, and proceed as suggested in "Comments" for page 23.

Ask the children to open their books to page 24, and give them directions for the picture exercises. When they have finished these exercises, give them directions for Exercises A to H at the right of the page.

A transparent overlay may be used to check this page.

25 Comments

On this page the children are required to distinguish between the plus sign and the minus sign to show the action indicated.

This page is like pages 23 and 24 in purpose and technique, except that both addition and subtraction are included.

Introduce this page by asking the children to look it over for a minute or two. Let them tell what they think they are supposed to do. Ask questions, and guide the discussion until they mention that the pictures show both addition and subtraction. Let them do the exercises independently.

A group of slow learners may need to use markers for Exercises A to H at the right of the page. Give each child 7 markers. Tell the children to read each sentence carefully, then use markers to find the answer. Remind them that the words plus and

minus tell them whether they are to add or subtract. Remind them also to write the correct sign in the second sentence in each exercise.

A transparent overlay showing the correct answers may be used to check this page.

26 Comments

On this page the children use simple pictorial problems to review and practice the addition and subtraction basic facts for the groups of 3, 5, and 7.

For the first time the children are required to complete sentences that are written without reference to the concrete aspects of a situation. The children must be able to read and understand the numerals and signs of operation. They match each sentence with a picture and write the answer on the line provided. Note that there is no picture for Exercise F.

To introduce the page, select at random five or six of the basic facts on page 26 and write them on the chalkboard. Put some books or blocks, or other objects large enough to be seen by all the children, on a table. Have a child read the first exercise. Use the books to perform the action indicated. Let the children tell what numeral should be written on the line, and have one of the children write it. Continue this activity until all the exercises on the board have been completed.

Average or bright children will complete the work on this page in one class period. Slow learners may need to spend two periods on it. For the first period they might match each exercise with a picture and write the letter of the exercise in the blue response space in the picture. For the second period they could use markers to find the answer to each exercise and write it on the blue line.

A transparent overlay may be used to check this page.

27 Comments

On this page the children get further practice with the addition and subtraction basic facts for the groups of 3, 5, and 7.

Introduce the page by reviewing briefly the three ways of writing the addition and subtraction basic facts shown on the page. Write on the chalkboard two or three exercises like those in each of the three columns on the page. Let various children write the answers on the lines provided.

Do not permit the use of markers with Worksheet 27 unless you are sure such help is really needed.

A transparent overlay may be used to check this page.

28 Comments

On this page the children use the words *add* and *subtract* in reading situations.

Exceptional care should have been taken with the preliminary teaching for this page. *Add* and *subtract* are technical words, and the children have had few chances to hear or use them outside the arithmetic class. They must learn to read these words and associate them with all the various arithmetic ideas that are implicit in their meaning. When a child reads the sentence "Add 2 and 5," he should understand that the action suggested is that of combining two groups, that a group of 5 is to be joined to a group of 2, that it means "2 plus 5" and "2 + 5," and that the numerical result of the action should be given. He should understand that he summarizes all this in the statement "2 + 5 is 7."

When he reads "Subtract 2 from 3," he should understand that the

action suggested is that of taking a group away from a larger group, that 3 is the number associated with the group he starts with, that 2 is the number associated with the group he removes, that it means "3 minus 2" and "3 - 2," and that the numerical result of the action should be given. He should understand that he summarizes these ideas in the statement "3 - 2 is 1."

The activities suggested in "Preliminary Teaching" for this page introduce and teach these concepts. The exercises on Worksheet 28 provide experience in using them.

Introduce Worksheet 28 with some exercises similar to the picture exercises on the page. Put some books or other objects large enough to be seen by all the children on a table or desk. Write the words *add* and *subtract* on the board, and draw a short line below the words. Use the books to demonstrate either an addition fact or a subtraction fact, and ask a child which word (*add* or *subtract*) is suggested by what you did. Then ask him to go to the board and cross out the word that does not correspond with what you did. Ask him to write the proper numeral on the line. Repeat this activity until the children understand that they are to leave the word that is associated with what happened and cross out the word that is not. You can vary the exercise somewhat by letting one child perform the action with the books while another child crosses out the word that is not wanted and writes the answer.

A bright group should do the work on this page in one class period. An average group may need two periods and a slow group two or more. If it is absolutely necessary, let the slow learners use markers to find the answers to Exercises A to F.

A transparent overlay may be used to check this page.

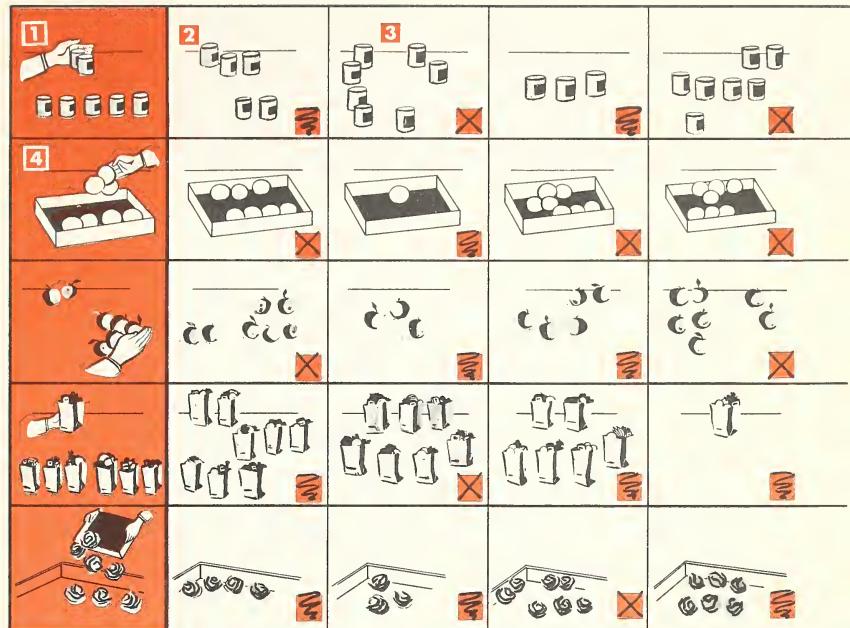
17

1 Review the response marks X and \diagup . Direct attention to the top blue picture. Ask how many cans are standing on the shelf and how many are being pushed toward them. Ask how many there will be in all.

2 Have the children look at the first white picture in the top row. Ask if it correctly shows the result of the action indicated in the blue picture. Tell the pupils that if it shows the two groups combined, or the correct number of cans, they are to make an X in the blue response space; if it does not show the two groups combined, they are to make the mark \diagup .

3 Have the children make the correct mark in each of the other pictures in the top row.

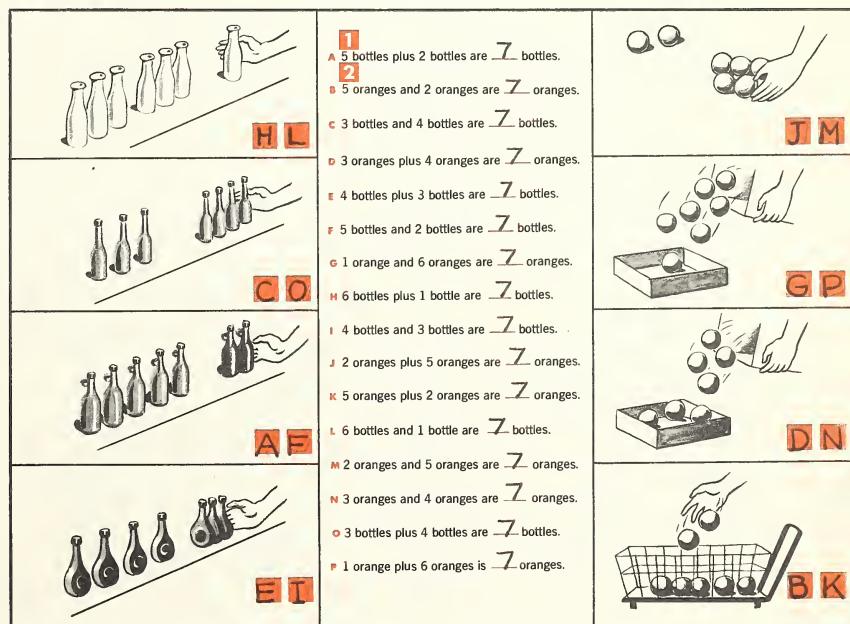
4 Tell the children to follow the same procedure for each of the other four rows of pictures on the page.

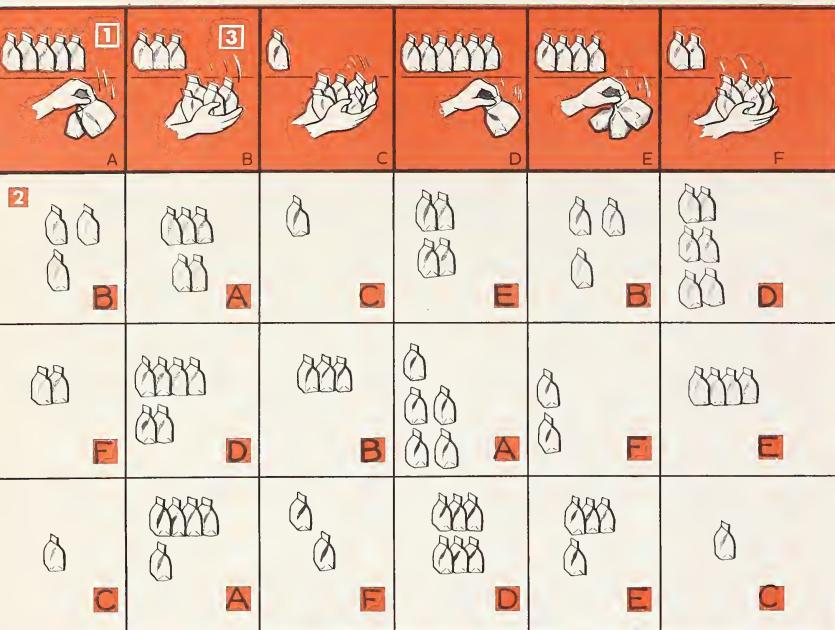


18

1 Tell the children to read Sentence A, find the picture that it tells about, and write the letter A in one of the blue response spaces. They should then complete the sentence by writing the appropriate numeral on the blue line.

2 Have the children follow the same procedure for each sentence on the page. You may wish to point out that all the pictures of bottles are on the left side of the page and all the pictures of oranges are on the right side. Point out that there are two sentences for each picture.

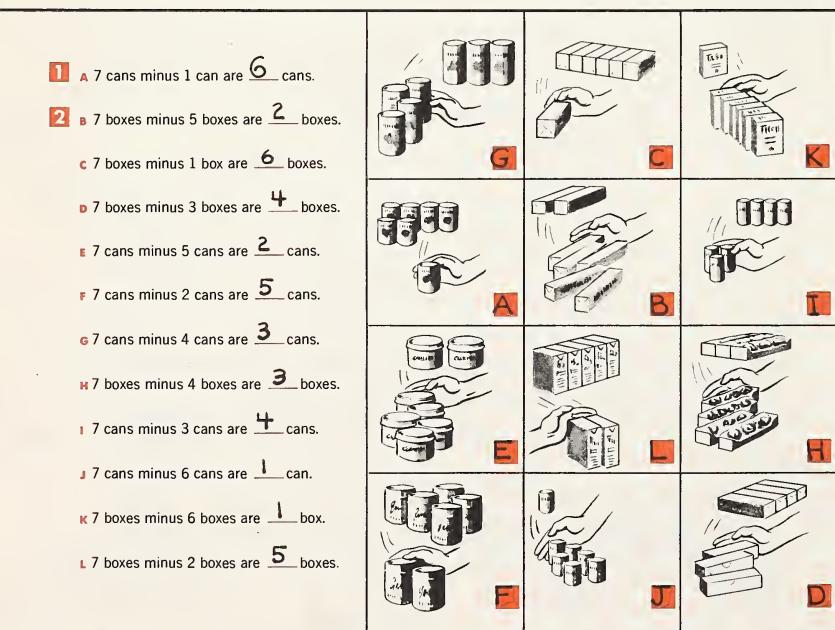




1 Call attention to Picture A. Ask how many bags in all are in the picture, how many are being taken away, and how many will be left.

2 Tell the children to look at each of the white pictures. In each picture that shows how many bags will be left in Picture A, they are to write the letter A in the blue response space.

3 Ask the children to follow the same procedure for Pictures B, C, D, E, and F.



1 Tell the children to read Sentence A and find the picture it tells about. Have them write the letter A in the response space in the picture, and then write the answer on the blue line in the sentence.

2 Have the children follow the same procedure for each sentence on the page.

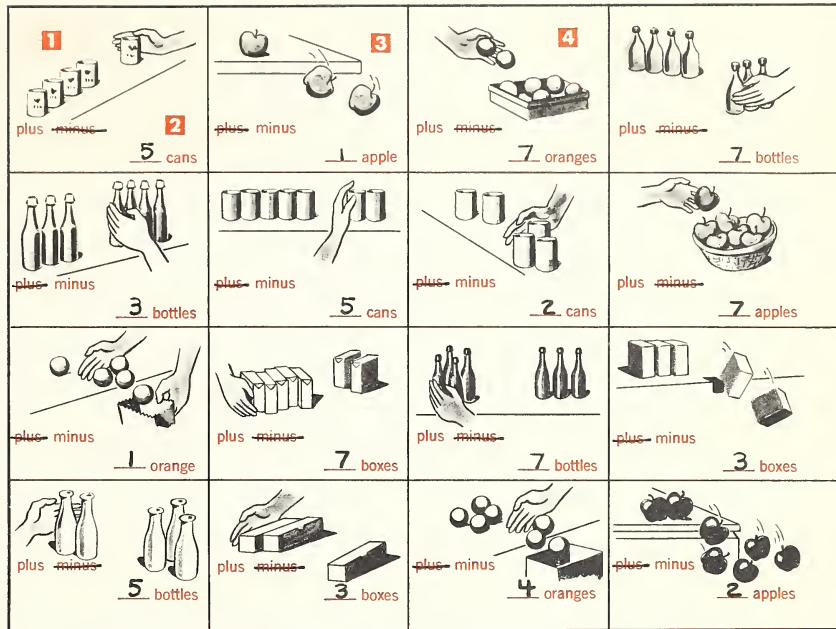
21

1 Ask what is happening in the first picture and which word, plus or minus, is suggested by that kind of action. Tell the children to cross off the wrong word.

2 Ask how many cans there will be in all when the action is completed. Tell the children to write the numeral for that many on the blue line.

3 Direct attention to the second picture and repeat the above procedure. Tell the children to write, on the blue line, the numeral that tells how many apples will be left when the action is completed.

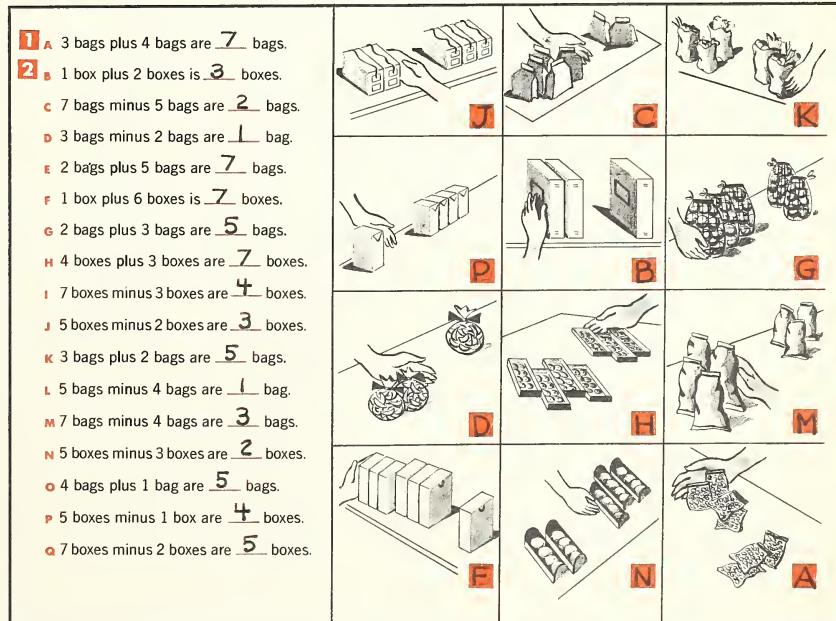
4 Have the children follow the same procedure for each picture on the page.



22

1 Tell the children to read Sentence A and find the picture it tells about. Have them write the letter A in the response space in the picture, then write the answer on the blue line in the sentence.

2 Have the children follow the same procedure for each of the other sentences on the page.





4 girls plus 3 girls are 7 girls. 1
4 plus 3 is 7 2
4 + 3 is 7 3



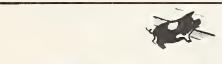
5 boys plus 2 boys are 7 boys.
5 plus 2 is 7
5 + 2 is 7



3 birds plus 2 birds are 5 birds.
3 plus 2 is 5
3 + 2 is 5



6 dogs plus 1 dog are 7 dogs.
6 plus 1 is 7
6 + 1 is 7



1 pig plus 2 pigs is 3 pigs.
1 plus 2 is 3
1 + 2 is 3



3 birds plus 4 birds are 7 birds.
3 plus 4 is 7
3 + 4 is 7

5

A 4 dolls plus 1 doll are 5 dolls.

$$4 + 1 \text{ is } 5$$

B 2 pigs plus 3 pigs are 5 pigs.

$$2 + 3 \text{ is } 5$$

C 1 bird plus 6 birds are 7 birds.

$$1 + 6 \text{ is } 7$$

D 2 apples plus 1 apple are 3 apples.

$$2 + 1 \text{ is } 3$$

E 1 boat plus 4 boats are 5 boats.

$$1 + 4 \text{ is } 5$$

F 2 toys plus 5 toys are 7 toys.

$$2 + 5 \text{ is } 7$$

G 3 cars plus 2 cars are 5 cars.

$$3 + 2 \text{ is } 5$$

H 5 balls plus 2 balls are 7 balls.

$$5 + 2 \text{ is } 7$$

1 Tell the children to read the first sentence in the first picture, look at the picture to decide what numerals belong on the blue lines, and write the numerals on the lines.

2 Have the children read the next sentence and write the correct numerals on the lines.

3 Tell the children to read the third sentence. Ask what sign should be written on the first blank. Tell them to write the appropriate sign and numeral on the blue lines.

4 Have the children follow the same procedure for each sentence in each picture.

5 Direct attention to Exercises A to H at the right of the page. Tell the children that for each exercise they are to write the correct numerals and the correct sign on the blue lines.



1 3 boys minus 1 boy are 2 boys.
2 3 minus 1 is 2
3 3 - 1 is 2



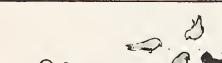
4 7 girls minus 4 girls are 3 girls.
7 minus 4 is 3
7 - 4 is 3



5 dogs minus 2 dogs are 3 dogs.
5 minus 2 is 3
5 - 2 is 3



7 birds minus 5 birds are 2 birds.
7 minus 5 is 2
7 - 5 is 2



7 birds minus 3 birds are 4 birds.
7 minus 3 is 4
7 - 3 is 4



5 pigs minus 4 pigs are 1 pig.
5 minus 4 is 1
5 - 4 is 1

5

A 3 dogs minus 1 dog are 2 dogs.

$$3 - 1 \text{ is } 2$$

B 7 pigs minus 6 pigs are 1 pig.

$$7 - 6 \text{ is } 1$$

C 5 birds minus 4 birds are 1 bird.

$$5 - 4 \text{ is } 1$$

D 7 boys minus 4 boys are 3 boys.

$$7 - 4 \text{ is } 3$$

E 5 boys minus 1 boy are 4 boys.

$$5 - 1 \text{ is } 4$$

F 7 dogs minus 2 dogs are 5 dogs.

$$7 - 2 \text{ is } 5$$

G 5 boys minus 3 boys are 2 boys.

$$5 - 3 \text{ is } 2$$

H 7 pigs minus 1 pig are 6 pigs.

$$7 - 1 \text{ is } 6$$

1 Tell the children to read the first sentence within the first picture, look at the picture to decide what numeral belongs on the blue line, and then write the numeral on the line.

2 Have the children read the next sentence and write the correct numerals on the lines.

3 Ask the children to read and complete the third sentence. Remind them that a sign belongs on the first blank.

4 Have the children complete each sentence in each picture on the page.

5 Direct attention to Exercises A to H at the right of the page. Point out that there are no pictures to go with these exercises. Tell the children that for each exercise they are to write the correct numerals and the correct sign on the blue lines.

25

Ask the children to look at the first picture, then read and complete each sentence.

Have the children complete each sentence for each picture on the page.

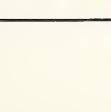
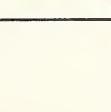
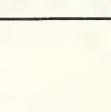
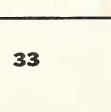
Direct attention to Exercises A to G at the right of the page. Point out that there are no pictures to go with these exercises. Tell the children to write the correct numerals and sign the blank lines in each exercise.

| | | |
|---|---|---|
|  3 pigs minus 1 pig are 2 pigs. $3 - 1 = 2$ |  5 birds plus 2 birds are 7 birds. $5 + 2 = 7$ | 3 A 7 toys minus 3 toys are 4 toys. $7 - 3 = 4$ |
|  6 pigs plus 1 pig are 7 pigs. $6 + 1 = 7$ |  7 dogs minus 5 dogs are 2 dogs. $7 - 5 = 2$ | B B 2 boats plus 5 boats are 7 boats. $2 + 5 = 7$ |
|  5 dogs minus 3 dogs are 2 dogs. $5 - 3 = 2$ |  2 birds plus 3 birds are 5 birds. $2 + 3 = 5$ | C C 4 boxes plus 1 box are 5 boxes. $4 + 1 = 5$ |
| | | D D 5 bags minus 2 bags are 3 bags. $5 - 2 = 3$ |
| | | E E 3 cans plus 2 cans are 5 cans. $3 + 2 = 5$ |
| | | F F 5 plants minus 1 plant are 4 plants. $5 - 1 = 4$ |
| | | G G 7 balls minus 1 ball are 6 balls. $7 - 1 = 6$ |
| | | H H 4 cars plus 3 cars are 7 cars. $4 + 3 = 7$ |

26

Ask the children to read Exercise A, find the picture that goes with it, write the letter A in the blue response space in the corner of the picture, and write the correct numeral on the blue line in the exercise.

For each exercise have the children follow the same procedure.

| | | | | |
|---------------------------------|---|---|--|---|
| 1 A $3+2$ is 5 |  |  |  |  |
| 2 B $7-2$ is 5 |  |  |  |  |
| C $5-1$ is 4 |  |  |  |  |
| D $3+4$ is 7 |  |  |  |  |
| E $4+1$ is 5 |  |  |  |  |
| F $7-1$ is 6 | | | | |
| G $7-5$ is 2 | | | | |
| H $6+1$ is 7 | | | | |
| I $7-3$ is 4 | | | | |
| J $5-3$ is 2 | | | | |
| K $2+1$ is 3 | | | | |
| L $2+5$ is 7 | | | | |
| M $3-2$ is 1 | | | | |
| N $4+3$ is 7 | | | | |
| O $7-4$ is 3 | | | | |
| P $5+2$ is 7 | | | | |
| Q $5-4$ is 1 | | | | |

- 1**
 A 1 dog plus 1 dog is 2 dogs.
 B 7 pigs minus 2 pigs are 5 pigs.
 C 5 rabbits minus 3 rabbits are 2 rabbits.
 D 2 balls plus 3 balls are 5 balls.
 E 7 cars minus 1 car are 6 cars.
 F 3 boys minus 1 boy are 2 boys.
 G 1 doll plus 6 dolls are 7 dolls.
 H 4 girls plus 3 girls are 7 girls.
 I 7 birds minus 4 birds are 3 birds.
 J 5 toys minus 1 toy are 4 toys.
 K 2 kittens plus 1 kitten are 3 kittens.
 L 5 apples minus 4 apples are 1 apple.
 M 6 oranges plus 1 orange are 7 oranges.
 N 1 boat plus 4 boats are 5 boats.
 O 7 boxes minus 5 boxes are 2 boxes.
 P 1 plant plus 2 plants are 3 plants.
 Q 7 apples minus 3 apples are 4 apples.

- 2**
 A 5 plus 2 is 7.
 B 2 plus 3 is 5.
 C 2 minus 1 is 1.
 D 1 plus 4 is 5.
 E 5 minus 3 is 2.
 F 7 minus 6 is 1.
 G 7 minus 2 is 5.
 H 1 plus 6 is 7.
 I 4 plus 3 is 7.
 J 3 minus 2 is 1.
 K 5 plus 2 is 7.
 L 7 minus 1 is 6.
 M 5 minus 2 is 3.
 N 1 plus 1 is 2.
 O 3 plus 4 is 7.
 P 7 minus 5 is 2.
 Q 5 minus 4 is 1.

- A 2+3 is 5.
 B 7-6 is 1.
 C 3-1 is 2.
 D 6+1 is 7.
 E 5-3 is 2.
 F 7-2 is 5.
 G 1+2 is 3.
 H 5-1 is 4.
 I 3-2 is 1.
 J 2+5 is 7.
 K 1+1 is 2.
 L 7-3 is 4.
 M 1+6 is 7.
 N 4+3 is 7.
 O 5+2 is 7.
 P 2-1 is 1.
 Q 3+4 is 7.

1 Direct attention to the exercise identified by blue letters (the first column). Tell the children to read each exercise and write the correct number on the blue line.

2 Have the children write the correct numeral on the blue line in each exercise in the next two columns.

| | |
|---|--|
|  1 add subtract <u>2</u> rabbits |  2 add subtract <u>3</u> kittens |
|  add subtract <u>1</u> chicken |  4 add subtract <u>5</u> dogs |
|  add subtract <u>2</u> pigs |  5 add subtract <u>7</u> birds |

3
 A 2 cars plus 1 car are 3 cars.
 Add 2 and 1. $2+1$ is 3.
 Subtract 1 from 2. $2-1$ is 1.

4
 B 3 balls plus 2 balls are 5 balls.
 Add 3 and 2. $3+2$ is 5.
 Subtract 2 from 3. $3-2$ is 1.

c 5 boats minus 2 boats are 3 boats.
 Add 5 and 2. $5+2$ is 7.
 Subtract 2 from 5. $5-2$ is 3.

d 3 books minus 2 books are 1 book.
 Add 3 and 2. $3+2$ is 5.
 Subtract 2 from 3. $3-2$ is 1.

e 5 dogs plus 2 dogs are 7 dogs.
 Add 5 and 2. $5+2$ is 7.
 Subtract 2 from 5. $5-2$ is 3.

f 2 dolls minus 1 doll are 1 doll.
 Add 2 and 1. $2+1$ is 3.
 Subtract 1 from 2. $2-1$ is 1.

1 In the first picture, ask the children to decide which word, *add* or *subtract*, is suggested by the action. Tell them to cross out the other word. Ask how many rabbits there will be in all when the action is complete. Have the children write the number on the blue line.

2 Have the children work independently on each of the remaining picture exercises.

3 Tell the children to read the first sentence in Exercise A and write the answer on the blue line. Ask them to read the two parts below (beginning with the words *Add* and *Subtract*), decide which part belongs with the first sentence, and cross out the other part. Then they should write the answer on the blue line in the part that begins with the first sentence.

4 Have the children work independently on Exercises B to F.

29-36 THE BASE-TEN SYSTEM OF NUMERATION TO 99

Objectives

Understanding arithmetic depends upon an understanding of the principles of the base-ten system. This system enables us to name each number and is the basis for the computational processes.

The two basic ideas of the base-ten system are: first, grouping by tens; second, using a symbol to represent ones, tens, hundreds, thousands, etc., and showing by position which of these the symbol represents. These principles of grouping and place value are used in our written numerals and in our number words. For example, "7" stands for 7 ones, "77" stands for 7 groups of 10 and 7 ones, and "seventy-seven" is a short way of saying "seven groups of ten and seven ones."

Children learn the principles of the base-ten system by observing how a large group of objects can be organized into groups of ten and single objects, by making such groupings themselves, and by manipulating objects to show what happens when a group is either increased by ten or by one or decreased by ten or by one. They learn to record such groupings first by using tally marks and then by writing numerals in place of the tally marks. They learn to write numerals for the decade and "teen" numbers and to understand place value.

Since the number words for the "teens" do not follow the general pattern of the number words within the other decades, study of the "teens" should be deferred until the children have learned the general pattern.

On Worksheets 29-36, only numbers less than 100 are studied. Worksheets 29 and 30 present grouping by tens and ones for groups of 20 to 99 and writing numerals from 20 to 99.

Worksheet 31 presents the decade numbers (10, 20, 30, etc.). Worksheet 32 presents the "teens."

Worksheets 33 and 34 give special attention to the order of numbers within the decades. On Worksheets 35 and 36, the effects of increasing and decreasing groups by ten and by one are studied.

Preliminary Teaching

Before using Worksheets 29-36, the children must be able to make groups of tens and ones, to make tallies that show place value, and to write numerals in place of the tally marks. They must learn the names and symbolism of the decade numbers and the "teen" numbers and the function of the numeral zero in the ones' column.

You should have on hand several collections of 100 small objects that can be stacked or arranged in pyramids or bundles of 10. These objects might be small blocks, peg sticks, straws cut in 3-inch lengths, tongue depressors, spools, corks, or small boxes of uniform size. You will also need a collection of objects that are large enough to be seen by the children when you use them for demonstrations. The children will need paper on which to make tally marks.

First build a pyramid in the 4, 3, 2, 1 arrangement. Be sure all the children can see it. Discuss the number of blocks in the pyramid. Give each child 10 objects that can be stacked in pyramid form. Let each child count his objects and build a pyramid. Be sure all the children know that any pyramid in the 4, 3, 2, 1 arrangement can immediately be recognized as 10.

Now build another pyramid just like the first one. Say: "How many blocks are in the first pile? How many are in the second pile? How can we count to see how many blocks there

are in the two piles?" If necessary, remind the children that when they count two groups of 10, they say "ten, twenty." Continue this activity until you have made 9 pyramids and have reviewed counting the decades to 90.

Remove all but three pyramids. Let the children count the piles of blocks, first saying "one ten, two tens, three tens," and then "ten, twenty, thirty." Then remove one block from the third pile. Get them to see that now they cannot count this pile as a 10 because it does not have 10 blocks in it; they cannot say "ten, twenty, thirty," but must say "two tens and nine ones," or "twenty-nine."

Set up three groups of 10 and some single objects and work with the children until they can count them "thirty-one, thirty-two," etc. Continue this activity with various combinations of piles of 10 and single objects until you are sure they can count groups of 10 and ones correctly. Be sure the children understand the principle of counting decades and counting nine or fewer objects for fewer than a decade.

When the children can count tens and ones with reasonable facility, put an uncounted group of objects on a table in the front of the room. Ask a child to make as many groups of 10 as he can and to count the ones that are left. Then say: "I am going to make a mark on the board for each group of 10 objects." As the child counts the tens aloud, make a tally mark on the board for each group he counts. Then say: "Now I am going to make a mark on the board for each single object. We must not get the marks for the tens and the marks for the ones mixed up; so I will put the marks for the ones over here." Let the child count the ones, while you make a tally mark for each some distance to the right of the marks for the tens. Let several children take turns

in re-counting the tens and the single objects and checking the tally marks for each. The marks for the tens and the marks for the ones should be of the same kind and size, and they should be kept separate.

Repeat this activity with a different number of tens and ones. This time, when you have made the tally marks for the tens and the ones, point to the tally marks at the left and ask: "What does each of these tally marks stand for?" [10 objects, or a pile of 10 objects] Point to the marks at the right, and ask: "What does each of these tally marks stand for?" [1 object] Then ask how many tally marks there are that stand for groups of 10. Write the corresponding numeral under the tally marks for the tens and repeat for the tally marks that stand for the single objects. Rewrite the two numerals so that they are close together, and tell the children how to read the resulting numeral (for example, "fifty-two"). Repeat this activity several times, each time using a different number of tens and ones. After the first or second time, let various children make the tally marks on the board and write the numerals.

To prepare for the next activity, give each child a sheet of paper and a large collection of small objects. Each paper should be divided into two sections by a vertical line (the paper may be folded, or the line may be drawn).

In this activity the children are asked to write numerals. If they do not know how to write numerals, let them use markers with numerals written on them. Each child who cannot write the numerals should have a complete set of ten markers showing the numerals 1 to 9 and zero. Learning to write numerals should be a special, separate learning task, and should not be undertaken during the period the children spend on arith-

metic activities. If they already know how to write numerals, encourage them to do so neatly and legibly.

On a table in the front of the room, arrange several pyramids of 10 blocks. Ask the children to make the same number of groups of 10 with their objects. Check to see that they have made groups of 10, and that the groups are clearly separated and are on one side of their desks. Near the pyramids on the table, place several single blocks. Tell the children to arrange the same number of single objects on their desks next to the groups of 10. Then tell them to make a tally mark on their papers for each group of 10. Ask them on which side of the fold or line they are going to put the marks for the groups of 10. Be sure these marks are put on the left side. Next have the children tally the single objects, and be sure they make the marks on the right side of the fold or line. Ask them to count the tally marks that stand for groups of 10 and write the numeral under the tally marks for tens. Have them do the same for the tallies that stand for the single objects. Discuss the meaning of these numerals. Finally,

have the children rewrite the two numerals so that they are close together. Ask a child to read the resulting numeral. Repeat this activity until you are sure the children understand the principle of tallying groups of 10 and single objects, and then writing numerals in place of the tally marks. Be sure they know that in a two-digit numeral the position of each digit indicates whether it stands for groups of 10 or for single objects.

Next, separate the class into groups of 8 or 10. Have some of the children in each group take turns making groups of 10 and ones with small objects while the other children make tally marks on their papers and write under the tally marks the two numer-

als that tell the number of groups of 10 and of single objects. Then the children should rewrite the numerals as a two digit numeral, read it, and tell what each of the digits stands for. You should supervise this activity so that you can be sure the children are working correctly. Be sure they work only with groups of 20 or more. (No "teen" numbers are to be considered at this point.)

This part of the work is very important. Adequate time to achieve good understanding should be spent on the activities described above.

[Worksheets 29 and 30 can be used at this point.]

In the following activities the children continue using the names of the decade numbers (ten, twenty, etc.) and learn the symbolism (10, 20, etc.) for them in the proper sequence. They also learn the meaning of zero as it is used in these numerals.

First, repeat quickly the activity in which you build pyramids of 10 objects and have the children count the pyramids by decades. Be sure the children know all the decade names and understand that they represent tens.

Next, set up four pyramids. Draw a short vertical line on the board. As one of the children to go to the board and make tally marks for the four groups of 10. Be sure he knows where he should make the tallies on the left side of the line. Ask: "Are there any single objects? Is there any reason to put tally marks on the other side of the line? Now write under the tally marks for tens the numeral [4] that tells how many tens there are. What does this numeral mean?"

Then say, "Since there are no ones, let's put a zero over here [opposite the 4 and under the space for the tally marks for ones] to show that there are no ones." Then rewrite the numerals close together [as "40"]. Tell the children that this numeral

read "forty" and it means 4 tens. Be sure the children understand the use of zero in this situation.

Repeat the above activity for other decade numbers. Occasionally use some tens and ones. Help the children understand that in writing a decade numeral there must be, besides the numeral for tens, a numeral for zero in ones' place.

[Worksheet 31 can be used at this point.]

In the activities that follow, the children are taught to understand the "teen" numbers. The number words eleven through nineteen are used orally with this page. Give special attention to eleven and twelve, which are difficult because they do not follow the same pattern as the other "teen" numbers.

You may wish to start making a numeral chart at this point. This chart may be made on a large sheet of oaktag. Rule it into ten vertical columns, using ink, and ten horizontal rows, using pencil. (The penciled lines are merely a guide for aligning the numerals.) Leave the top box in the first column blank. Then write or stamp each of the numerals from 1 to 9, in order, in the remaining boxes of this column. Write or stamp each of the numerals from 10 to 19 in the second column, starting with the top box. As the children complete the activities that follow, the numerals should be included on the chart. The completed chart will show all the numerals from 1 to 99.

Set up a pile of 10 blocks on a table in the front of the room. Place 5 single blocks next to it. Ask a child to draw a short vertical line on the board. Ask how many tens there are, and let the child make a tally mark for 1 ten at the left of the line. Have him make tally marks for the ones at the right of the line. Have him write the numerals for the tens and the

ones under the tally marks. Then have him write the numeral 15. Be sure the children know that it means 1 ten and 5 ones. Tell the children that this is read "fifteen," and that we say "teen" for ten. Repeat this activity with different children tallying different "teen" numbers. While one child is working at the board, let the other children make tally marks and write numerals at their desks.

When you have presented all nine "teen" numbers two or three times each in this way, give each child 19 small objects. Let the children take turns counting to a specified number from one to nineteen. As one child counts aloud, the other children should count out the same number of markers on their desks. Then they should make a group of 10, tally the ten and the ones, and write the appropriate numeral. Repeat this activity until all the "teen" numbers have been counted several times.

Next, have the children make a group of 10 objects and then count "ten, eleven, twelve," etc., to a specified number. Repeat this activity until all the "teen" numbers have been used several times to count. Be sure they understand that in the "teen" decade the tens' numeral remains the same [1], while the ones' numeral changes successively from 1 to 9.

Write sets of "teen" numerals on the board in correct order, but leave spaces for some numerals that are missing. Let the children read these numerals and supply those that are missing as they read. Also, have them write the missing numerals in the proper places.

Finally, have the children arrange, in correct order, cards or markers with the "teen" numerals written on them. You might place large cards on the tray of the chalkboard and let a few children arrange them in the correct sequence. Or you may wish to

have the children work at their desks with small markers or cards that show the "teen" numerals.

[Worksheet 32 can be used at this point.]

In the activities that follow, the children learn that the numerals in the ones' column go through the same sequence from 1 to 9 in each decade.

Have enough objects on hand so that the children can count to 99.

Arrange two pyramids of 10 objects each on a table at the front of the room. Place a single object beside the pyramids. Have the children count "ten, twenty, twenty-one." Include more single objects, one by one, and let the children continue to count "twenty-two, twenty-three," etc. Repeat this activity for several different decades. Be sure to include some of the higher decade numbers. Get the children to see that the numbers within each decade are counted in the same way from 1 to 9.

On subsequent days develop each decade separately and in order. Have the children tally the tens and ones and write the appropriate numerals as you go through each decade.

To make sure the children can begin counting at any point and continue counting to 99, use procedures similar to the following. You might say: "There are 44 sticks [stones, buttons, etc.] in this box, and there are some more on the table. Let's count to see how many there are in all. We'll begin with this stick on the table and say 'forty-five.' John, count all of the sticks. Put each stick in the box as you count it." Give each child one or more opportunities to count. Vary the beginning point. Be sure that the child begins counting with the next number after the one corresponding to the number of objects in the box.

[Worksheets 33 and 34 can be used at this point.]

The activities that follow show the children how to change the number symbol when a quantity is increased by 1 or by 10.

Set up six pyramids of 10 objects each on a table in the front of the room. Put 6 single objects beside the pyramids. Give each child a sheet of paper. Say: "How many tens are there? How many ones are there? On the right-hand side of your paper, write the numeral that tells how many tens and ones there are. Write it near the top." Put another single object with the 6 objects. Ask: "How many tens are there now? How many ones are there now? Under the numeral you just wrote, write the numeral that tells how many tens and ones there are now. In what way is this numeral different from the one you wrote first?" Say: "Now we will start over again." Remove one object from the 7 single objects. Get the children to see that now there is the same number of tens and ones that there was to begin with.

Make another pyramid of ten. Say: "How many tens are there now? How many ones? How many more tens are there than there were at first? Write the numeral that tells how many tens and ones there are now. How is this numeral different from the first numeral you wrote?" Repeat this activity several times working within different decades. Each time use one more single object first. Then restore the original grouping. Finally, add one more ten.

Next, repeat the activity above, but have the children *imagine* that more objects are being included. For each arrangement you make, ask them to write the numeral that tells how many there would be if another one and then another ten were included with the objects on the table. Check their work to see that they are writing the correct numerals.

The children should now be able to write the numerals for the numbers from 1 to 99 when they are dictated in random order. Give occasional exercises of this kind from now on.

[Worksheet 35 can be used at this point.]

Adapt the activities above to show the children how to change the number symbol when a quantity is decreased by one and by ten.

[Worksheet 36 can be used at this point.]

29 Comments

On this page the child learns to count by tens and ones, to make tally marks for tens and ones in positions that have "place value," and to write number symbols in place of the tally marks.

No special introduction is needed for this page if the activities suggested in "Preliminary Teaching" have been used. Tell the children to open their books to Worksheet 29, and give them directions for the page.

Remember that the work in this unit is extremely important, and as much time as necessary should be spent on it.

When the children have finished the work on this page, be sure to discuss each picture with them. Let them take turns reading their responses. A response should take this form: "4 tens 3 ones; forty-three."

30 Comments

On this page the child continues to make tally marks to represent groups of objects and to write two-digit numerals to replace the tally marks.

The "Comments" for the previous page apply to this page also.

Introduce the page by reviewing briefly the work done on page 29. Ask the children to look at page 30

and tell what they think they are supposed to do. Be sure they count and tally the groups of 10 first, then the single objects.

Have the children read and discuss their responses when they have finished the work on this page.

31 Comments

On this page the child learns the names and the symbolism of the decade numbers 10, 20, 30 . . . to 90. They learn to write the numerals in proper sequence. They also learn to use the numeral zero in the ones' column.

To introduce this page, give each child a 3" x 5" card. Have each child write one of the decade numerals (10, 20, 30, etc.) on his card. Have ready some larger cards on which you have drawn groups of pyramids (X's) with 10 in each pyramid. Lay them face up on a table. Ask the children to take turns in selecting cards and arranging them on the chalkboard tray in sequence from 10 to 90. If a child makes a mistake, let another child tell why the card chosen is the wrong one and find the correct card.

Next, use the cards on which the children wrote decade numerals. Ask who wrote the numeral 10 on his card. Have this child put his card next to the large card that shows a group of 10. Ask if someone wrote the numeral for the next group of pyramids and let him put his card [20] next to the large card with two pyramids. Continue in this way through 90. If there is no small card for one of the large cards, ask what numeral is missing. Have a child make a card for it. At the end of this activity, there should be a card showing pyramids and a card showing the accompanying numeral for 10, 20, 30 . . . to 90.

Before any of the children start the work below the pictures on page 31, show them exactly what they are to do. Write on the board a series of numerals like those at the bottom of the page. Have a child cross off the numerals that are not in sequence and write the missing numerals where they belong. Let other children in the class tell him which numerals should be crossed off and which numerals should be inserted. Work with the children while they do Row A in their Workshops.

When the children have completed the picture exercises, let them compare and discuss their answers. Let them do the same for the exercises at the bottom of the page.

32 Comments

On this page the child learns the names and the symbolism of the "teen" numbers. He learns to write these numerals in their proper sequence. This page is like page 31, except that it deals with "teen" numbers. The "Comments" for page 31 apply to this page also.

Introduce the page by reviewing what was done on page 31. Ask the children to look at page 32. Be sure they notice that each picture shows only one group of 10 and some single objects, and that each of the numerals at the bottom of the page is either 10 or a "teen" numeral. If you wish, you might prepare cards for an activity like the one suggested for page 31.

Most children should be able to finish this page in one lesson. When they have finished, let them compare and discuss their work.

33 Comments

The exercises on this page are to be done in two steps. First, the children

are to count the groups of 10 and single objects in each picture and write (without tallying) the numeral that tells how many objects there are. Then, for the four pictures in a strip, they are to write on the brown lines the numerals for the strip in ascending order.

To introduce this page, draw on the board three or four pictures of groups of 10 and single objects. (Pyramids of X's and single X's will work very well.) These pictures should represent numbers within the higher decades and should not be arranged in numerical order. Ask various children how many objects there are in each picture, and have a child write the appropriate numeral under each picture. Then ask which picture shows the fewest objects. Have a child write this numeral on the board. Ask which picture shows the next larger number of objects, and have a child write that numeral under the other one. Repeat until all the numerals under the pictures have been rewritten in a column in the proper sequence. Get the children to notice that the numerals have been placed in order, beginning with the numeral that represents the fewest objects.

Tell the children to open their books to page 33. Let them tell what they think they are to do with it. If necessary, give them directions.

Most children should be able to finish this page in one lesson. When they have finished, let them compare and discuss their answers.

34 Comments

The exercises on this page are similar to those at the bottom of pages 31 and 32, except that they involve more complexities in determining the sequences.

To introduce this page, ask the children what they think they are to

do with it. Be sure they understand that the first numeral on each line is the starting point for a sequence. If necessary, work through Row A with the children. Slow learners may need help with most of the page. Encourage these children to work independently on some of the exercises if they possibly can. Note that there is more than one correct way of crossing off and inserting numerals.

When the work is finished, the children should discuss and compare their answers.

35 Comments

On this page the child learns how to change the number symbol when the quantity it represents is increased by one and when it is increased by ten.

If the work suggested in "Preliminary Teaching" has been done, no special activity will be needed to introduce the page. Give the children directions for the first picture, and let them work independently on the other five pictures. Then give them directions for Exercises A to Q at the right of the page.

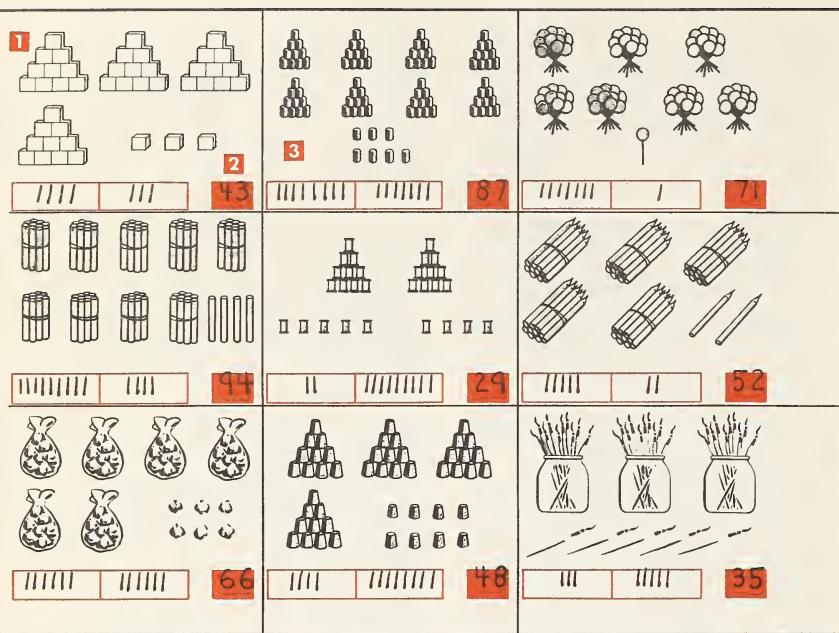
The children should discuss and compare their answers. Let the slow learners discuss their answers for the pictorial exercises before they go on to the other exercises.

36 Comments

On this page the child learns how to change the number symbol when the quantity it represents is decreased by one and when it is decreased by ten.

This page is like page 35, except that the children are to decrease each quantity shown. The "Comments" for page 35 apply to this page also.

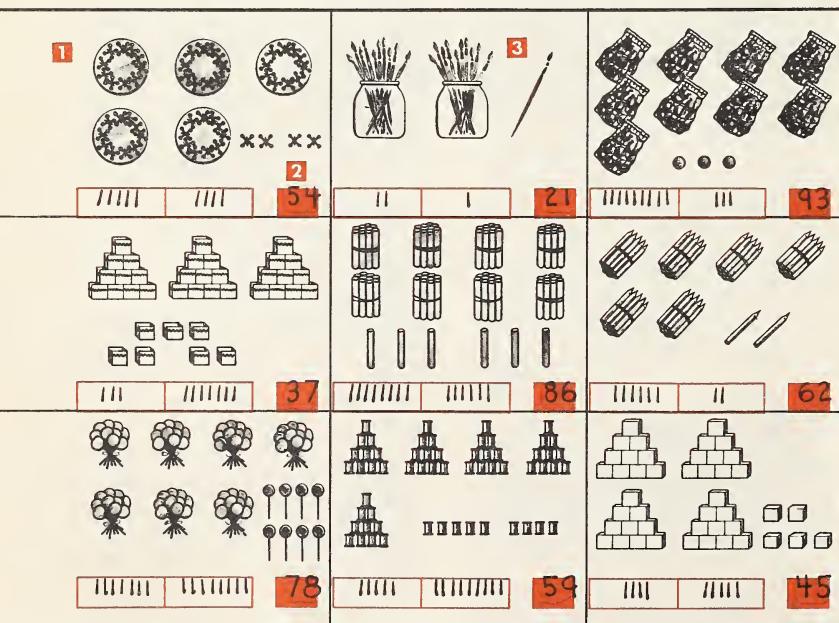
Let the children discuss and compare their answers.



1 Direct attention to the first picture. Get the children to observe that there are 10 blocks in each pyramid. Tell them to make a tally mark for each group of 10 in the left-hand part of the white answer strip. Tell them to make a tally mark in the right-hand part of the white answer strip for each single block in the picture.

2 Tell the children to write a numeral in the blue response space in place of the tally marks.

3 Have the children follow the same procedure for each picture on the page. Let them discuss and compare their answers.



1 Point out that the pictures on this page are like those on page 29. Direct attention to the first picture. Have the children make a tally mark for each group of 10 in the left-hand part of the white response strip and a tally mark for each single jack in the right-hand part of the response strip.

2 Tell the children to write a numeral in the blue response space in place of the tally marks.

3 Have the children follow the same procedure for each picture on the page. Let them read and discuss the responses in the same way they did for page 29.

31

Tell the children that there are 10 sticks in each bundle. Tell them to cross off enough bundles of sticks in the first picture so that it will show 10 sticks. Then they should write in the blue answer space the numeral [10] that tells how many sticks belong in this picture.

In each picture on the page, have the children cross off bundles of sticks so that each picture shows 10 more sticks than the picture before it. In each response space they should write the numeral that shows how many sticks belong in the picture. Point out that in some pictures they may not need to cross off any bundles.

For Rows A to E, starting with the first numeral in each row, the children are to cross off numerals that are not in the proper sequence and insert numerals that are missing.

| | | | | | | | | | | | |
|------------|---|---|---|---|---|---|--|---|--|-----------|-----------|
| |  |  |  |  |  |  |  |  | | | |
| 1 | 10 | 2 | 20 | 3 | 30 | 4 | 40 | 5 | 50 | 6 | 60 |
| 7 | 70 | 8 | 80 | 9 | 90 | 10 | 10 | 11 | 11 | 12 | 12 |
| 13 | 10 20 30 40 50 50 60 70 80 90 | 14 | 10 20 30 40 50 60 70 80 90 | 15 | c 20 30 40 50 60 70 80 90 90 100 | 16 | d 20 30 40 50 60 70 80 90 90 | 17 | e 10 20 30 40 50 60 70 80 90 80 | 18 | 19 |
| 3 A | 10 20 30 40 50 50 60 70 80 90 | B | 10 20 30 40 50 60 70 80 90 | C | 20 30 40 50 60 70 80 90 90 100 | D | 20 30 40 50 60 70 80 90 90 | E | 10 20 30 40 50 60 70 80 90 80 | | |

Other responses might be given. The ones shown are illustrative only.

32

The children are to cross off blocks so that the pictures will illustrate the numerals 11 to 19 in ascending order. Have them cross off enough blocks in the first picture so that it will show 11 blocks. They should then write in the answer space the numeral [11] that tells how many blocks belong in this picture.

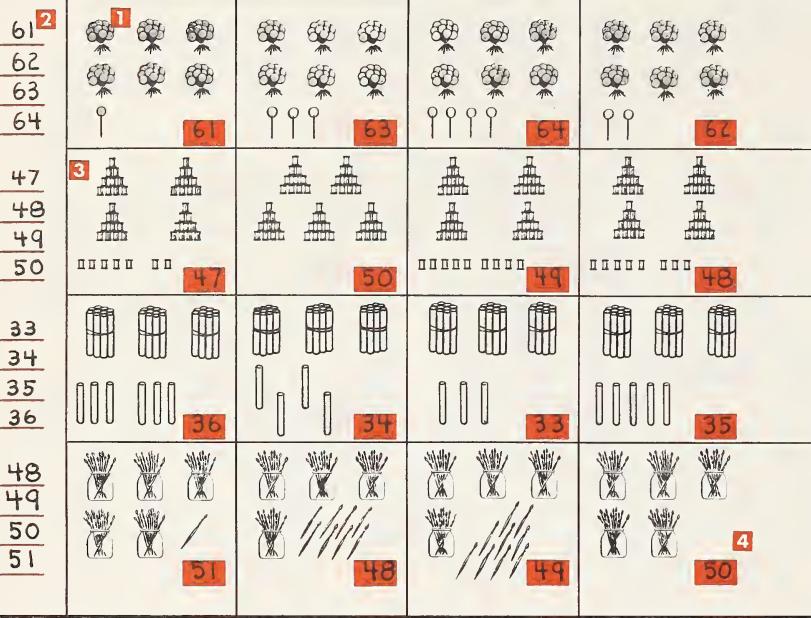
In each picture, have the children cross off blocks so that it shows 1 more block than the picture before it. Have them write in the answer space the numeral that tells how many blocks belong in the picture.

Call attention to Rows A to E, starting with the first numeral in each row, the children are to cross off numerals that are not in the proper sequence and insert numerals that are missing.

| | | | | | | | | | | | | |
|-----------|---|---|---|---|---|--|--|---|--|--|---|--|
| |  |  |  |  |  |  |  |  |  | | | |
| 1 | 11 | 2 | 12 | 3 | 13 | 4 | 14 | 5 | 15 | 6 | 16 | |
| 7 | 17 | 8 | 18 | 9 | 19 | 10 | 10 11 12 13 13 14 15 15 16 17 17 18 18 19 | B | 10 11 12 13 13 14 15 15 16 17 17 18 18 19 | C | 11 12 13 13 14 15 15 16 17 18 18 19 19 | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | D | 10 10 11 12 13 13 14 15 15 16 17 18 18 19 | E | 10 11 12 12 13 14 15 15 16 17 18 18 19 |

Other responses might be given. The ones shown are illustrative only.

33



- Ask the children how many lollipops there are in the first picture. Have them write the correct numeral in the brown answer space. Tell them that for each of the other pictures in the top strip (the lollipops), they are to write the appropriate numeral in the answer space.

- Have the children observe the four brown lines at the left of the pictures. Tell them to write, on the first line, the numeral that represents the smallest number of lollipops; on the second line, the numeral that represents the next larger number, etc. Help the children while they do the work for the first strip.

- Have the children follow the same procedure for the other three strips of pictures.

- When the children have finished the work on this page, let them discuss and compare their answers.

34

Other responses might be given. The ones shown are illustrative only.

| | | | | | | | | | | | | | |
|-----|----|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----|----|
| 1 A | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | | | |
| 2 B | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | | |
| C | 15 | 16 | 17 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| D | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | | | |
| E | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | | |
| F | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 |
| G | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | | | |
| H | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | | | |
| I | 43 | 44 | 45 | 46 | 47 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 |
| J | 66 | 67 | 67 | 68 | 68 | 69 | 70 | 71 | 72 | 73 | | | |
| K | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | |
| L | 42 | 43 | 44 | 45 | 45 | 46 | 47 | 48 | 49 | 49 | 50 | | |

3

- Call attention to Row A. Tell the children that the numerals are to be arranged in sequence from 24 to 33. Numerals that are not in sequence are to be crossed off, and numerals that are missing are to be inserted. Work through Row A with the children.

- Tell the children to follow the same procedure for Rows B to L.

- When the children have finished, let them compare and discuss their work.

35

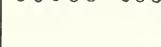
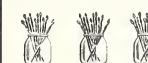
1 Ask the children how many sticks are shown in the first picture. Have them write the numeral on the first brown line.

2 Ask the children how many sticks there would be if the sticks were increased by one. Have them write the numeral on the second brown line.

3 Ask the children how many sticks there would be if ten more sticks were put with the sticks in the picture. Have them write the numeral on the last brown line.

4 Have the children follow the same procedure for each of the other pictures on the page.

5 For each exercise in A to Q, the children are to write on the first line the numeral that means the quantity indicated has been increased by one and on the next line the numeral that means the quantity indicated has been increased by ten.

| | | | | |
|---|---|---|---|--|
| |  |  |  | |
| |  |  |  | |
| |  |  |  | |
| 1 | 45 | 60 | 29 | |
| 2 | 46 | 61 | 30 | |
| 3 | 55 | 70 | 39 | |
| 4 | | | | |
| |  |  |  | |
| |  |  |  | |
| |  |  |  | |
| | x | | | |
| | 51 | 78 | 32 | |
| | 52 | 79 | 33 | |
| | 61 | 88 | 42 | |
| | | | | |

36

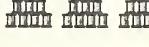
1 Call attention to the first picture. Ask the children how many objects are shown. Have them write the numeral on the first brown line.

2 Ask the children how many objects there would be if one object were removed. Have them write the numeral on the next brown line.

3 Ask the children how many objects there would be if ten objects were removed. Have them write the numeral on the last brown line.

4 Tell the children to follow the same procedure for each of the other pictures on the page.

5 For each exercise in A to Q, the children are to write on the first brown line the numeral that means the quantity indicated has been decreased by one and on the next brown line the numeral that means the quantity indicated has been decreased by ten.

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|---|---|---|---|--|
| |  |  |  | |
| |  |  |  | |
| | | | | |
| 1 | 40 | 39 | 72 | |
| 2 | 39 | 38 | 71 | |
| 3 | 30 | 29 | 62 | |
| 4 | | | | |
| |  |  |  | |
| |  |  |  | |
| |  |  |  | |
| | 61 | 27 | 54 | |
| | 60 | 26 | 53 | |
| | 51 | 17 | 44 | |
| | | | | |

37-39 COUNTING MONEY BY TENS AND ONES

Objectives

One practical use of number in daily life is dealing with money. Children must learn to recognize coins, know their names, and recognize equivalent values. On pages 37-39 the principles of the base-ten numeration system are applied to counting amounts of money. Collections of pennies, nickels, and dimes are organized into piles of 10 cents each. These piles are counted by using the decade names (*ten, twenty, thirty, etc.*), and any ungrouped pennies are counted by ones. The equivalent values of coins are pointed out. Thus, a pile worth 10 cents might be made up of 10 pennies, a dime, 2 nickels, or one nickel and 5 pennies. On these worksheets the idea of organizing coins by tens and ones for ease in counting is emphasized.

Preliminary Teaching

Before using Worksheets 37-39, the children must be able to recognize pennies, nickels, and dimes. They must know that "one cent" is another name for "one penny," that 10 pennies are equal in value to one dime, that 5 pennies are equal to one nickel, that 2 nickels are equal to one dime, and that one nickel and 5 pennies are equal to one dime.

Have sufficient coins on hand so that the children can use various combinations of coins to represent different amounts of money. One dollar in dimes, one dollar in nickels, and one dollar in pennies should be sufficient. If the children can bring coins from home, have each child bring 2 dimes, 2 nickels, and 10 pennies. If it is impossible to provide real coins for the children, use toy money. However, any substitute for real coins is unsatisfactory, since a great part of learning to identify

coins, to count them, and to make change depends on physical familiarity with the coins themselves—their feel, appearance, size, etc.

Show the children some pennies, nickels, and dimes, and be sure they can name and identify the coins. Be sure they know the term "cent" and understand that the term "penny" is often used instead of "cent." Ask how much such familiar things as candy, ice-cream cones, pencils, etc. cost. Let them set up a store on a table and pretend to buy pencils. Provide a quantity of pencils or peg sticks, and tell the children they cost one cent each. Let the children take turns buying the pencils. (You may control this activity by selling the pencils yourself.) Let them buy any number of pencils up to 20, and have them count out the exact amount of money needed. If a child buys 10 pencils and pays for them with 10 "pennies," ask if some other coin, or coins, could be used. If he pays with a dime or two nickels, ask the same question.

When you are sure the children understand that 10 pennies, or 2 nickels, or one dime, or one nickel and 5 pennies all have the same value, put a collection of pennies on the table and ask the children if they can think of any way to make them easy to count. Get them to suggest making piles of 10. Let several children make piles of 10 pennies. Be sure some single pennies are left over. Then have the children count the pennies by tens and ones. Remind them always to say "cents" after the amount ("ten cents, twenty cents, thirty cents, thirty-one cents, thirty-two cents," etc.). Vary the number of piles of 10 pennies and the number of single pennies several times, and give each child a chance to count the money aloud.

Make three or four stacks of 10 pennies each. Ask a child to count the pennies by tens aloud. Tell the other children to watch and count silently. Then take away one stack of pennies, and put a dime in its place. Ask a child to count the coins by tens again. Establish that the total amount of money is the same as before. Substitute a dime for another stack of pennies and repeat the procedure. Repeat until you have substituted dimes for all the stacks of pennies; then substitute stacks of pennies for some of the dimes. Be sure the children understand that the total amount of money remains the same, no matter what combination of dimes and stacks of 10 pennies is used. Next, substitute a stack of 2 nickels for one of the dimes or one of the stacks of 10 pennies. Proceed as before until many different combinations of stacks of 10 pennies, dimes, and stacks of 2 nickels have been used to make up the same amount of money. Let each child have several opportunities to count the money aloud.

Next put 38 cents on the table. Use any combination of coins you wish for the groups of 10, but have 8 pennies. Have the children count the money by tens and ones. Then substitute a nickel for five of the single pennies, and ask a child to count the money. Repeat this activity with various amounts of money until you are sure the children can count amounts of less than 10 cents both in pennies and in a combination of a nickel and pennies.

If sufficient coins are available, let the children show specified amounts (35¢, 42¢, 18¢, etc.), using as many combinations of coins as they can. If they have brought some money from home, they can use their own coins for this activity.

Now ask a child to decide on some amount (not to exceed 99¢) and

represent this amount with piles of coins, each pile worth 10¢, and single pennies. Let another child change the coins in some of the piles without changing the value of the piles. A third child should then count the money. Let other children show other amounts with coins.

[Worksheets 37 and 38 can be used at this point.]

Make some price tags like those on page 39. On each tag write a numeral for an amount of money less than 99¢. Be sure to put the cent sign after each amount. Let the children bring small toys from home, or use toys and objects that are available in the classroom. Pictures cut from magazines and pasted on cards may also be used. Set up a store on a table, and let the children take turns buying and selling the toys. Be sure they pay for each toy with the exact amount of money indicated on the price tag, since they have not yet been taught how to make change. The child who is acting as storekeeper should count the money given him and suggest another combination of coins that would make up the same amount. Let each child have at least one turn.

[Worksheet 39 can be used at this point.]

37 Comments

On this page the child learns to count money by tens and ones. He also learns the equivalent values of pennies, nickels, and dimes.

If experiences with money are to have any meaning for the children, they must be real. Since money must necessarily be represented by pictures on the pages of this workshop, it is necessary to establish in the child's mind the connection between real money and these pictures. It is assumed, therefore, that the children have performed the activities sug-

gested in "Preliminary Teaching" and have used real money.

To introduce this page, ask the children what they think the circles with numerals in them stand for. Get them to notice the rows in which the pennies overlap. Point out that there are ten pennies in some of these rows and five pennies in others. If the children have brought coins from home, direct them somewhat as follows: "Look at the first picture. What do the circles with the numeral 1 on them stand for? How many pennies are there in the first row? Put a stack of 10 pennies on the row. What do the circles with 10 on them stand for? Put a real dime on the dime in the brown part of the picture. Are there any other dimes in the brown part of the picture? Are there any dimes in the white part of the picture? Move the real dime to one of the dimes in the white part of the picture. Are there any other rows of 10 pennies in the picture? Are there any single pennies? Move the stack of 10 pennies away, and put a penny on each single penny in the picture. What do the circles with 5 on them stand for?" Continue in this way until the children have accepted the pictures as representing real money and have had several experiences in moving real coins from a pictured coin within the brown area to a coin of the same denomination in the white space.

Give the children directions for the work on the page and help them with the first three exercises. Let them do the last two rows independently. When they have finished, let them compare and discuss their answers.

38 Comments

On this page the child continues to count money by tens and ones.

No special introduction should be needed for this page. Tell the children

to open their books to Worksheet 38, and let them tell what they are to do. If necessary, work through one or two exercises with them, and let them finish independently. Be sure they remember to write the cent sign in each answer.

When the children have finished, let them compare and discuss their work.

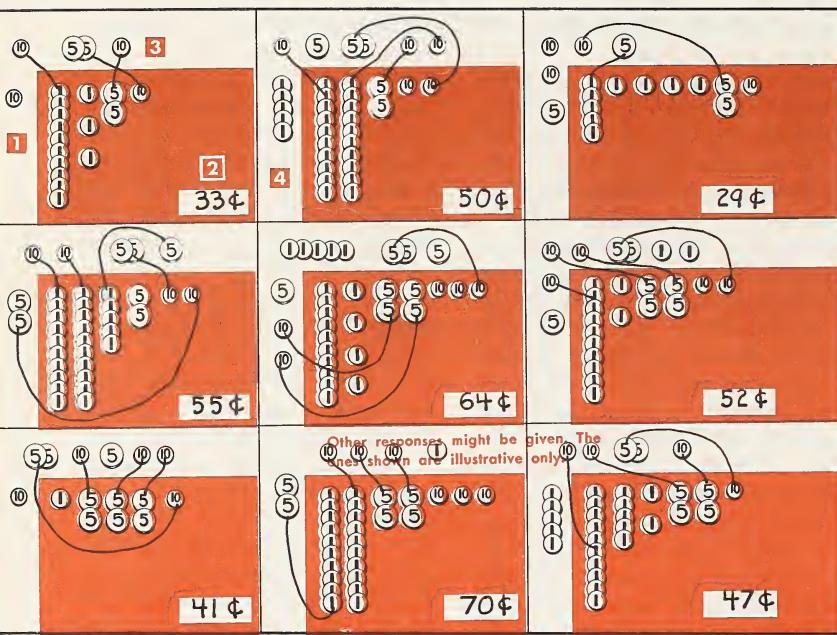
39 Comments

On this page the children get further experience in counting money by tens and ones. They also get some practice with addition and subtraction basic facts involving amounts of money.

If the storekeeping activity suggested in "Preliminary Teaching" has been used, no special introduction to this page will be needed. Have the children open their books to Worksheet 39, and let them talk about the toys in the pictures and how much they cost. Be sure they understand that in each picture the tag tells the price of the toy. Make clear to the children that, when encircling the pictures of coins, they must use both nickels in a stack of two nickels. They should use pennies for all amounts less than 10¢. Get them to see that even if there are several different combinations of coins they could use to buy the toy in a picture, they are to select only one combination of coins that makes up the amount.

Before the children do Exercises A to Q at the right of the page, explain that when amounts of money are added or subtracted, it is important to remember that the answer also represents money. Thus the answer must also include a cent sign.

When the children have finished the work, let them compare and discuss their answers.



1 Be sure the children understand that the circles with "1" on them mean pennies, those with "5" mean nickels, and those with "10" mean dimes. Point out that there are ten pennies in the row of overlapped pennies.

2 Tell the children to count all the money in the brown part of the picture by tens and ones. Then have them write, in the white answer space, the numeral that represents this amount. Remind them to write the cent sign after the numeral.

3 Next tell the children to draw a line from a coin (or a group of coins) in the brown part of the picture to a coin (or a group of coins) in the white part that has the same value.

4 Have the children follow the same procedure for each picture on the page. When they finish, let them compare and discuss their work.

| | | | |
|--|--|---|--|
| 1 10 55 55 55 1 1 1 53¢ | 2 10 10 10 10 55 55 55 55 1 1 1 1 1 1 1 1 1 1 89¢ | 55 1 1 1 13¢ | 10 55 55 55 1 1 1 1 1 45¢ |
| 10 55 55 1 1 1 1 1 1 1 37¢ | 10 10 10 55 55 1 61¢ | 10 55 1 1 1 1 24¢ | 55 1 1 1 1 1 1 16¢ |
| 10 10 10 55 55 1 1 1 1 54¢ | 10 10 1 1 1 1 1 1 1 1 28¢ | 10 10 10 10 10 10 55 1 1 1 1 73¢ | 55 55 55 1 1 32¢ |
| 10 10 10 55 55 55 55 55 1 91¢ | 10 55 55 55 55 55 55 55 55 1 1 1 1 1 1 76¢ | 10 10 55 55 1 1 42¢ | 10 10 10 55 55 55 1 1 1 1 1 65¢ |

1 Direct attention to the first picture. Remind the children that the circles with numerals on them stand for pennies, nickels, and dimes. Tell them to count the money in each picture by tens and ones and to write, in the brown answer space, the numeral that expresses the amount. Remind them to write the cent sign after the numeral.

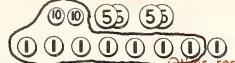
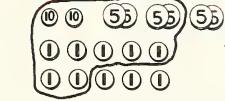
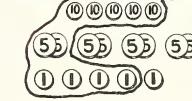
2 Have the children follow the same procedure for each picture on the page. When the children have finished, let them compare and discuss their work.

1 Direct attention to the first picture. Tell the children that the boat costs 27¢, and that they are to select coins in the picture that they could use to buy it. Remind them that if they use nickels, they must use a stack of two nickels. Tell them to draw a ring around the coins they would use to buy the boat.

2 Have the children follow the same procedure for each picture on the page.

3 For Exercises A to Q, tell the children to write the answer to each exercise on the brown answer line.

4 When the children have finished, let them discuss and compare their answers.

| | | |
|--|--|---|
|   <small>Other responses might be given. The ones shown are illustrative only.</small> |   | A Add 3¢ and 4¢. <u>7¢</u> B 6¢ plus 1¢ are <u>7¢</u> . C 5¢ - 1¢ are <u>4¢</u> . D 7¢ minus 3¢ are <u>4¢</u> . E 3 minus 2 is <u>1</u> . F 4 + 1 is <u>5</u> . G 5¢ + 2¢ are <u>7¢</u> . H Subtract 6 from 7. <u>1</u> I Subtract 2¢ from 7¢. <u>5¢</u> J Add 3¢ and 2¢. <u>5¢</u> K 5¢ minus 3¢ are <u>2¢</u> . L 1 + 2 is <u>3</u> . M Add 1 and 6¢. <u>7¢</u> N 3¢ + 2¢ are <u>5¢</u> . O 7¢ - 4¢ are <u>3¢</u> . P 1¢ plus 6¢ is <u>7¢</u> . Q Subtract 3 from 5. <u>2</u> |
|   |   | |
|   |   | |

40-49 THE GROUP OF 6

Objectives

The five addition and five subtraction basic facts for the group of 6 are introduced in this section of worksheets. The addition basic facts are introduced first. The activities suggested in "Preliminary Teaching" and the exercises on the worksheets are similar in form and identical in purpose to the activities and exercises for the addition basic facts for the groups of 3, 5, and 7. The subtraction basic facts for the group of 6 are taught by using the same organization of ideas used to teach the subtraction basic facts for the groups of 3, 5, and 7.

One aspect of the basic facts for the group of 6 has not been encountered in connection with the other groups studied thus far. A

group of 6 can be formed by combining equal groups (either three groups of 2, or two groups of 3), and it can be separated into the same equal groups. If one says "2 threes are 6" (instead of "3 plus 3 is 6"), attention is focused on the equality of the groups that are to be combined and the number of these groups. In this case, the operation is multiplication rather than addition. If, on the other hand, one says "6 is 2 threes" (instead of "6 minus 3 is 3"), attention is focused on the equality of the groups that are separating and the number of these equal subgroups. Now the operation is division instead of subtraction.

Special attention should be given to the combining of equal subgroups to make a group of 6 and to the separating of 6 into equal subgroups. Such attention will provide prepara-

tion for later work in division and multiplication, but the words multiplication and division and the signs of operation (\times and \div) should not be introduced at this time. These words and signs will be taught when multiplication and division are formally studied.

The word equals is introduced on page 43, and the equals sign (=) is introduced on page 47. When the children have learned to use the equals sign, they will be able to read, write, and understand sentences that are written entirely in mathematical symbols.

Preliminary Teaching

Before the children use Worksheets 40-49, they should be able to combine groups of 4 and 2, of 2 and 4, of 5 and 1, of 1 and 5, of 3 and 3, and of 2, 2, and 2 to make a group

of 6. They should also be able to separate a group of 6 into these sets of subgroups. They must understand that a group of 6 can be made up of two different sets of equal subgroups (2 threes or 3 twos), and that it can be separated into the same two sets of equal subgroups. They must learn the words equals and equal, and they must learn to use the equals sign (=).

The first two pages of this section of worksheets show pictures of children playing in the snow. If you wish to use the same type of setting for the preliminary teaching, the activities described below may be adapted to suggest winter and winter games.

Oral use of the words equal and equals should begin at this point. Make clear to the children that these words are used in arithmetic sentences in place of *is* and *are*. Later, when the children have become accustomed to using *equal* and *equals* orally, these words will be taught as reading words.

To begin the work, give each child 6 markers. Tell them to pretend that the markers are children. Have them arrange a group of 4 markers on one side of their desks and a group of 2 markers on the other side. Say: "Let's pretend two children are going to join four children. Push the group of 2 over to the group of 4. How many children are there altogether? Who can give me a complete sentence that tells what happened?" Get the children to make statements like "4 children plus 2 children are 6 children," "4 children plus 2 children equal 6 children," etc. Point out that 2 markers were added to 4 markers.

Call on six or seven children separately for the following activity. Have a child make two groups with his markers, push one group over to the other, and describe to the other members of the class what he is doing and the result. Let each child decide

what he wants to pretend his markers are. The other children should make the same groups and move their markers to show the same action while each child is having his turn. You should get statements like the following from the children:

"I am pretending that my markers are snowballs. I have a group of 5 snowballs and one single snowball. I am pushing the single snowball over to the 5 snowballs. I am going to add 1 snowball to 5 snowballs. There are 6 snowballs in all. 5 snowballs plus 1 snowball equal 6 snowballs." See that each of the five addition basic facts for the group of 6 is illustrated.

Next, tell the children to arrange their markers in two groups. Then say: "George, how many markers are there in each of your groups? How many other children arranged their markers in a group of 4 and a group of 2? Push one group over to the other group. Decide for yourselves which group you are going to move. Jane, which group did you move? How many markers are there in all? 4 markers plus 2 markers equal how many markers?" Make a tally mark on the board, and explain that it stands for one way to combine two groups to make a group of 6. Now ask: "Who pushed the group of 4 over to the group of 2? How many markers are there in all? 2 markers plus 4 markers equal how many markers?" Make another tally mark.

Ask the children if any of them have their markers in groups different from those already mentioned. For each addition basic fact follow the procedure outlined above. Make a tally mark on the chalkboard for each.

Now ask which children still have their markers arranged in two groups. Let the children tell you how many markers are in each group. Ask what is different about these two groups.

Get the children to state that the number of markers is the same in each group; and that no matter which group is moved, they still can say "3 markers plus 3 markers equal 6 markers" or "3 + 3 is 6." Put another tally mark on the board and explain why this basic fact is counted only once.

The children should realize that they have now studied all the ways of combining two groups to make a group of 6. If some child points out that three groups of 2 make a group of 6, explain that at this time we are thinking about combining only two groups to make a group of 6.

If any children have had difficulty with the work just completed, give them individual help.

[Worksheet 40 can be used at this point.]

On Worksheet 41 the children read and complete sentences. In the preliminary teaching for this page, be sure to use the words *equal* and *equals* orally, but use *is* and *are* in the sentences that you write on the board. Give the children 6 markers each. Tell them to pretend the markers are boys. Let them take turns in making up sentences like "2 boys plus 4 boys are how many boys?" Write each sentence on the board, using a blank instead of the words "how many," and have all the children arrange and move their markers to show what it means. Then let one of the children write the answer where it belongs.

Repeat this activity until there is a sentence on the board for each of the five addition basic facts for the group of 6. Then point to the sentences on the board in random order, and let the children take turns in reading them aloud. The other children should move their markers to show what the sentences mean. Continue until you are sure the children

can read and understand the sentences.

[Worksheet 41 can be used at this point.]

The subtraction basic facts for the group of 6 should be introduced and taught in much the same way that the subtraction basic facts for the groups of 3, 5, and 7 were taught. Give each child 6 markers. On a table or desk at the front of the room place 6 objects that are large enough to be seen easily by all the children. (Objects like paper sleds, snowmen, etc., will add interest. If you cannot supply such objects, use books, boxes, or blocks.) Adapt your questions to the objects you use. Have the children, one at a time, come to the table, tell how many objects are in the group, how many objects they are going to remove, move the objects, and tell how many are left. The other children should move their markers at their desks to show the same subtraction basic fact. This activity should be continued until each of the five subtraction basic facts for the group of 6 has been demonstrated several times.

Next, have the children demonstrate the subtraction basic facts for the group of 6 again, but this time have them make a sentence for each fact ("6 markers minus 2 markers equal 4 markers"). You may put a tally mark on the board for each fact. Remind the children that when they move a subgroup from a larger group, they subtract. Use the words *subtract* and *subtraction* as often as you can, and encourage the children to use them, too.

[Worksheet 42 can be used at this point.]

On page 43 the words *equal* and *equals*, which have been used orally in place of *is* and *are* up to this time, appear in Our Number Workshop 2 for the first time. Teach these words

according to your usual procedure for introducing new words.

First, review briefly the subtraction basic facts for the group of 6, using markers, books, or boxes on a table at the front of the room.

Next make sure the children can read and complete such sentences as "6 sleds minus 1 sled equal _____ sleds" and "6 - 5 equals _____" (for the blank, read "how many"). Use the same techniques that were used when you taught the subtraction basic facts for the 3, 5, and 7 groups. Give the children some markers, and let each child make a group of 6. Let various children take turns making up sentences like "6 sleds minus 4 sleds equal _____ sleds" and "6 - 3 equals _____. Write each sentence on the board. Let the children use their markers to find the answers, and let some of the children write the answers where they belong. Continue this activity until two such sentences for each subtraction basic fact for the group of 6 are on the board. Then point to the sentences in random order and ask a child to read the sentence you are pointing to while the other children move their markers to show what it means. Continue this activity until you are sure all the children can read and understand the sentences.

[Worksheet 43 can be used at this point.]

The purpose of the following activities is to make the children aware that sometimes equal groups are combined; and that when groups are equal, it is important to observe not only how many objects are in each group but also how many groups there are. They learn that when equal groups are combined, they can make a new kind of sentence about the action. Instead of saying "3 plus 3 equals 6," they can say "two groups of 3 equal 6." The children also learn

that certain groups can be separated into equal groups, and that they can express this kind of situation in a new way. Instead of saying "6 minus 3 equals 3," they can say "There are 2 threes in 6."

In this part of the work, emphasis should be placed on the equality of groups that can be combined to make a larger group or into which a larger group can be separated, as well as on the action of combining or separating. Have three pairs of children come to the front of the room. Tell one pair to stand at the left, one pair at the right, and one pair in the middle. Ask the class what they observe about the way the children are arranged. Accept all reasonable remarks, and continue the discussion until it is clearly stated that there are two children in each group and that there are three groups. Be sure someone points out that since the number of children in each group is the same, the groups are equal. Some child may say that 6 children are arranged in groups of 2. Direct the three groups of children to come together, and ask how many children there are in all. Ask the class to tell what happened, and continue the discussion until you get them to say "3 groups of 2 equal 6."

Arrange six other children in 2 groups of 3 at the front of the room. Ask questions, and guide the discussion until you get the class to say that there are 2 groups with 3 children in each, and that the groups are equal. Someone may remark that there are 6 children in 2 groups of 3. Have the two groups come together, and let the class describe what has happened. Work for the response "2 groups of 3 equal 6."

Now let the six children remain at the front of the room. Have other members of the class suggest ways in which they might be arranged in

equal groups. Try out each suggestion. Continue until the children understand that there are only two ways in which equal groups can be combined to make a group of 6: by combining 2 groups of 3 or 3 groups of 2.

Next give each child some markers, and tell the children to make groups of 6 by combining equal groups. Watch the children to see that they are following directions. If any child suggests combining 6 single objects, agree that it is another way to make a group of 6 but that we want to combine groups that have more than one object.

[Worksheet 44 can be used at this point.]

The activities suggested above for combining equal groups may be adapted to the separating of a group of 6 into equal groups. Start by having six children come to the front of the room. Ask them to arrange themselves in equal groups. They may separate into 2 groups of 3 or into 3 groups of 2. Ask the class to tell you what happened—how many children were in the group to begin with, how many groups they separated into, and how many children are in each of the subgroups. They should make special mention of the fact that the subgroups are equal. Finally, get them to say "There are 3 twos in 6" or "There are 2 threes in 6."

Let members of the class suggest ways of regrouping the six children. For each regrouping, be sure the children notice whether the groups are equal or not, and also notice, when the groups are equal, the number of children in a group and the number of groups. Continue this activity until the children realize that there are only two ways in which a group of 6 can be separated into equal groups: 2 groups of 3, or 3 groups of 2. If someone mentions 6 groups of 1, accept this as another

way to separate a group of 6 into equal groups, but suggest that here we are thinking of groups of more than one.

Let the children practice separating 6 markers into equal groups. Every child should work with the markers until he has found out for himself that there are only two ways to separate a group of 6 into equal groups and what the two ways are.

[Worksheets 45 and 46 can be used at this point.]

Write the equals sign (=) on the board, and explain to the children that it means exactly the same as the words *equal* and *equals*. Let the children practice making the sign on the chalkboard or on sheets of paper.

Write the following sentences on the board:

2 threes equal ____

3 twos = ____

6 equals ____ twos

6 = ____ threes

6 - 2 = ____

4 + 2 = ____

Have a child read the first sentence aloud, and have the other children show what it means with their markers. Let a child write the answer on the answer line. Ask a child to point to the sign that means the same as the word *equals*. Let another child read the second sentence, and have the class use markers to show what it means. Be sure the children know that the groups must be combined. In the same way, work through the third and fourth sentences. Be sure the children understand that now they must separate a group of 6 into equal subgroups. Then let them read and work out the fifth and sixth sentences, which are ordinary subtraction and addition. If you think the children need more practice in working out answers for sentences that are expressed entirely in numerals and symbols, write a few more sentences on

the board. Work with the children as they use markers to show the actions and find the answers.

[Worksheets 47, 48, and 49 can be used at this point.]

40 Comments

On this page the children study the addition basic facts for the group of 6. They look at a key picture of two groups that are about to be combined and select from four pictures those that show the result when the action has been completed.

To introduce the page, quickly review the five addition basic facts for the group of 6. Give each child a handful of markers. Direct the children to put 3 markers on one side of their desks and 3 markers on the other side. Say: "Move the markers on the right side over to the other markers. How many markers were in the group you did not move? How many markers were in the group you moved? How many markers are there in all? Make a sentence that tells what happened. Put 3 markers on each side of your desks again. This time move the group of markers on the left side over to the other group of markers. How many markers are there in all? Make a sentence that tells what happened. Is this sentence any different from the first sentence you made? Now put 2 markers on the left side of your desks and 4 markers on the right side," etc. Continue in this way until all the addition basic facts for the group of 6 have been reviewed.

When the children open their books to page 40, direct attention to the first brown key picture. Ask how many children there are in one group, how many in the other, what action it shows, and how many children there will be in all when the action is completed. Discuss each of the other

ey pictures in the same way. From the four pictures at the right of each ey picture, the children are to select those pictures that correctly show the result of the action illustrated in the brown picture. In each picture, the children are to make an X in the brown response space if the white picture shows a group of 6. If the picture does not show a group of 6, they are to make a scribble mark in the space.

An able or average group should complete the work on this page in one period. The suggestions made in "Comments" for page 10 (see page 6 of this Teaching Guide) for adapting those exercises to the abilities of a slow group can also be applied to this page.

This page may be checked by using a transparent paper overlay.

41 Comments

On this page the children are introduced to the symbolic form of the addition basic facts for the group of 6. Sentences symbolize the numeroseness of the groups and the action.

To introduce the page, give each child 6 markers and review quickly the five addition basic facts for the group of 6. Then write on the chalkboard several sentences like those on page 41. Have one child read a sentence while the other children move their markers to show what it means. Let a child write the answer on the answer line.

When the children open their books to page 41, give them directions for the page. They are to read a sentence, find the picture that illustrates the sentence, and write the letter of the picture in the brown response space in front of the sentence. Then they are to write the answer on the brown response line in the sentence.

A transparent overlay may be used to check this page.

42 Comments

On this page the children study the five subtraction basic facts for the group of 6.

To introduce the page, review the subtraction basic facts for the group of 6. Give each child 6 markers. Ask the children to remove a group of 5 markers from the 6 markers and tell how many are left. They should say, "6 markers minus 5 markers equal 1 marker." Have them remove groups of 4, 3, 2, and 1 from a group of 6, and each time let a different child state the subtraction basic fact. You may wish to tally each fact, so that the children can see that there are only five subtraction basic facts for the group of 6.

Have the children open their books to page 42. Have them look at the brown pictures. They should decide that there is one picture for each subtraction basic fact for the group of 6. For each brown picture they are to find all the white pictures that show the group that will remain. In the response space for each such picture they are to write the letter of the corresponding brown picture.

This page may be checked by using a transparent overlay.

43 Comments

On this page the children are introduced to the symbolic form of the subtraction basic facts for the group of 6.

To introduce the page, have the children recall the subtraction basic facts for the group of 6. As they tell what they are, write a sentence for each on the board, omitting the answer. When all the facts are on the board, point to them in random or-

der and let the children use their markers to find the answers. Let them give the answers verbally, but do not write the answers on the board.

Have the children open their books to page 43. Ask them if there is a picture for each subtraction fact for the group of 6. Then give them directions for the page, and let them do the exercises independently.

The work on this page should take no more than one arithmetic period. A slow group may need a little extra help with the new reading words equal and equals.

This page may be checked by using a transparent overlay.

44 Comments

On this page the children are required to distinguish between equal and unequal groups that are being combined to make a group of 6.

To introduce this page, give each child 6 markers. Tell the children to arrange the markers in equal groups. Ask several children how many groups they have, and how many markers are in each group. Let the children tell what is meant by equal groups. Be sure they realize that 6 markers can be arranged in equal groups in two ways—two groups of 3 and three groups of 2.

For each picture on Worksheet 44, the children are to make an X in the brown space if the groups coming together are equal. They are to make a scribble mark if the groups are unequal.

Worksheet 44 should take no more than one normal arithmetic period.

A transparent overlay can be used to check this page.

45 Comments

On this page the child is required to distinguish between equal and un-

equal groups when a group of 6 is separated into groups.

To introduce this page, use the same type of exercise you used to introduce page 44, but this time have the children separate the group of 6 markers into equal groups. Be sure they see that 6 markers can be separated into equal groups in two ways: two groups of 3 and three groups of 2. Let the children work with markers until you are sure they can distinguish between the sets of equal groups and the sets of unequal groups into which a group of 6 can be separated.

For each picture on Worksheet 45, have the children make an X in the brown space if the groups separating are equal, and make a scribble mark in the space if the groups separating are unequal.

Worksheet 45 should take no more than one normal arithmetic period.

A transparent overlay can be used to check this page.

46 Comments

On this page the child is required to distinguish between equal groups that are combining to make a group of 6 and equal groups into which a group of 6 is separating.

Although the words *multiplication* and *division* and the signs of operation \times and \div are not introduced in this book, combining equal groups and separating a group into equal groups are, of course, the basic actions that suggest multiplication and division. The emphasis placed on equality of groups, both now and in later units when the children work with groups of 8 and 10, helps the children to acquire ideas that gradually lead to the concepts of division and multiplication. This part of the work will not be successfully completed until the children clearly see

the difference between "2 threes equal 6" and "3 + 3 equals 6" and between "6 equals 2 threes" and "6 - 3 equals 3." These distinctions are rather difficult. The children should spend a great deal of time in working with markers and discussing in their own words, without using technical terms, the difference between the action that suggests multiplication and the action that suggests addition, and the difference between the action that suggests division and the action that suggests subtraction.

To introduce the page, write four sentences on the board, two that express multiplication and two that express division. These sentences may be selected from those on page 46. Ask various children to perform with markers the action expressed by a sentence, or let groups of children act out each sentence. When you are sure they understand the action of combining equal groups and separating a group into equal groups, and can relate each action to the correct sentence, ask them to open their books to Worksheet 46. Give them directions for the page.

Allow a slow group of children adequate time to do these exercises.

A transparent overlay may be used to check this page.

47 Comments

On this page the children learn to recognize and use the equals sign, and to read sentences expressed in numerals and mathematical symbols ($4 + 2 = 6$). They also get more practice with the basic facts for the group of 6 and more experience in distinguishing between combining and separating actions.

Before the children start the exercises on this page, be sure they recognize the equals sign and know what it means.

To introduce the page, write the following on the chalkboard:

3 twos = _____

2 threes = _____

Put six books or other large objects on a table. Arrange the books in two groups of 3, and move them together. Ask the children which of the sentences on the board tells about the action you just performed. Let one of the children complete the sentence. Repeat this procedure several times with different pairs of basic facts. (Any of the pairs of facts from page 47 may be used.) When you are sure that the children can discriminate among the four kinds of action (namely, those that lead to addition, multiplication, subtraction, and division), and that they can relate each action to the correct sentence, give them directions for Worksheet 47. Keyed notes for the work are given on page 57 of this Teaching Guide.

An average or slow group will take two class periods to complete the work on this page. It may be necessary to work through the top row of pictures with these children. Make clear that in each picture they are to cross out the *incorrect* sentence and then complete the *correct* sentence.

A transparent overlay can be used to check this page.

48 Comments

On this page the children get more practice in recognizing groupings and actions in pictures and in relating pictures to statements of basic facts.

Addition and subtraction basic facts for the groups of 3, 5, 6, and 7 are used in the exercises on this page. The children are to decide which sentence in a picture tells what is happening and cross out the sentence that does not belong. Then write the correct numeral on the answer line.

Introduce this page by quickly viewing the actions that suggest addition and subtraction. Write on the chalkboard several pairs of addition and subtraction basic facts like those on page 48. Use books or ge markers on a table to perform the action that leads to one of the facts in each pair. Let the children describe the action you performed. Have a child come to the board, cross out the incorrect statement of a fact, and write the numeral on the answer line. When you feel that the review of addition and subtraction is adequate, have the children tell what they are to do with the exercises on Worksheet 48. Most children should be able to complete the work on this page in one period.

A transparent overlay may be used to check the page.

49 Comments

On this page the children review the basic facts for the groups of 3, 5, 6, and 7.

On the left side of the page are eight pictorial exercises like those on page 48. On the right side of the page are three columns of exercises for which the children are to write the answers.

If necessary, introduce this page by reviewing very briefly the work on page 48. The children should have no difficulty with Worksheet 49, since the exercises are similar to the exercises they have been working on for several days. Make sure the children understand that no pictures accompany the exercises in the three columns at the right.

Allow adequate time to do the work on this page. Some children

may need to use markers to find the answers to the exercises in the columns. Such children should be encouraged to do the work for the second and third columns without using markers. You may wish to assign the pictorial exercises and the first column for the first period; then assign the second and third columns for the second period.

A transparent paper overlay may be used to check this page.

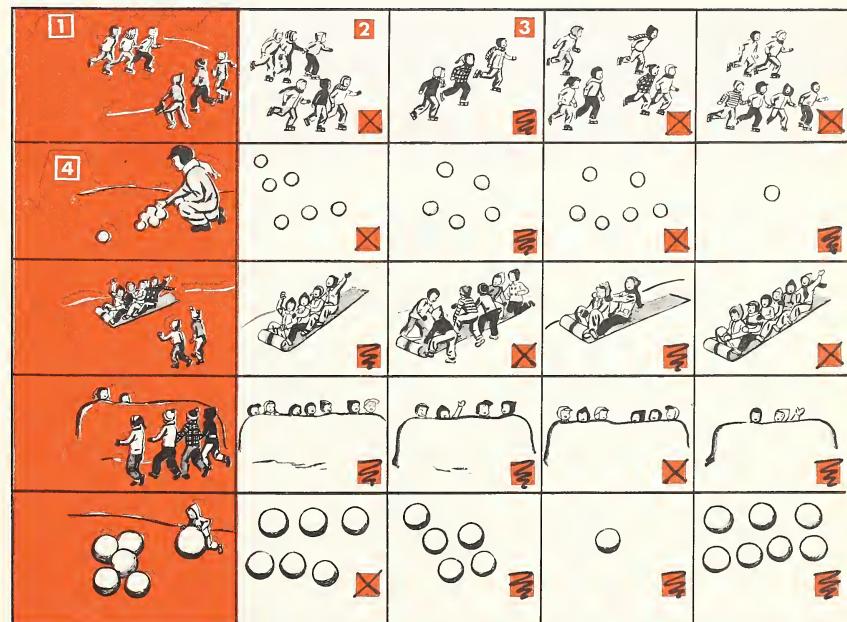
40

Direct attention to the first brown picture. Ask how many children are in each group, what action the picture shows, and how many children are in all.

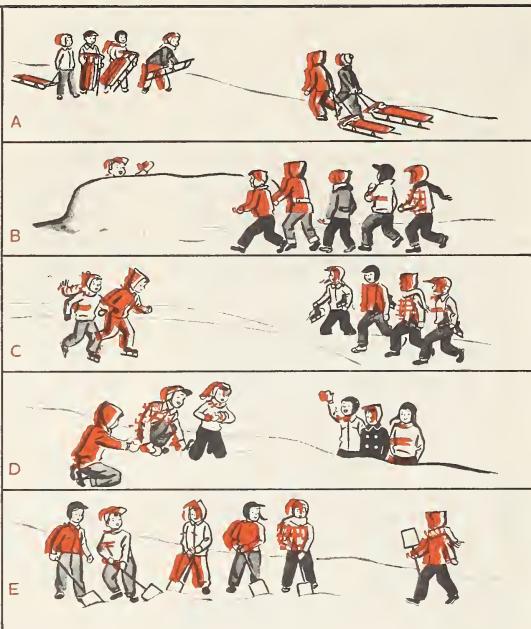
Tell the children to look at the first white picture in the top row and decide whether or not it shows the result of the action in the brown picture. If the picture shows 6 children, they are to put an X in the brown response space in the corner of the picture. If it does not, they are to make a scribble mark in the space.

Tell the children to make the appropriate mark in the brown space for each of the other white pictures in the first row.

Have the children follow the same procedure for each of the other rows of pictures on the page.

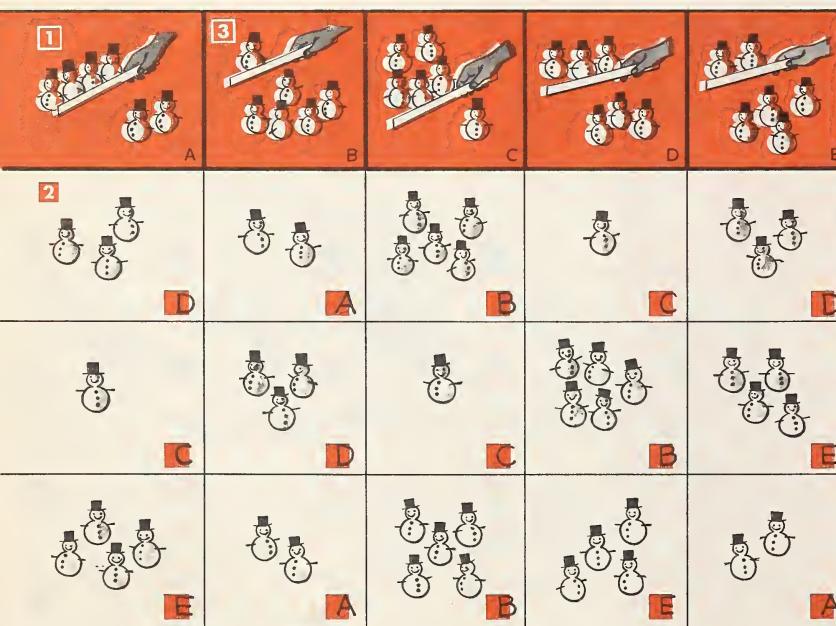


- 1** **B** 1 boy plus 5 boys is 6 boys.
2 **D** 3 plus 3 is 6.
A 4+2 is 6.
E 5 boys plus 1 boy are 6 boys.
B 1 plus 5 is 6.
A 4 boys plus 2 boys are 6 boys.
C 2+4 is 6.
B 1+5 is 6.
E 5 plus 1 is 6.
C 2 boys plus 4 boys are 6 boys.
D 3+3 is 6.
C 2 plus 4 is 6.
D 3 boys plus 3 boys are 6 boys.
E 5+1 is 6.
A 4 plus 2 is 6.



1 Tell the children to read the first sentence, find the picture that illustrates it, and write the letter of the picture in the brown space in front of the sentence. They should then write the answer on the brown line in the sentence.

2 Have the children follow the same procedure for each sentence on the page. Point out that they will have to use each picture more than once.



1 Direct attention to Picture A. Ask how many snowmen in all are in the picture, how many are being taken away, and how many will be left.

2 Tell the children to look at each of the white pictures. In each picture that shows how many snowmen will be left in Picture A, they are to write the letter A in the brown response space.

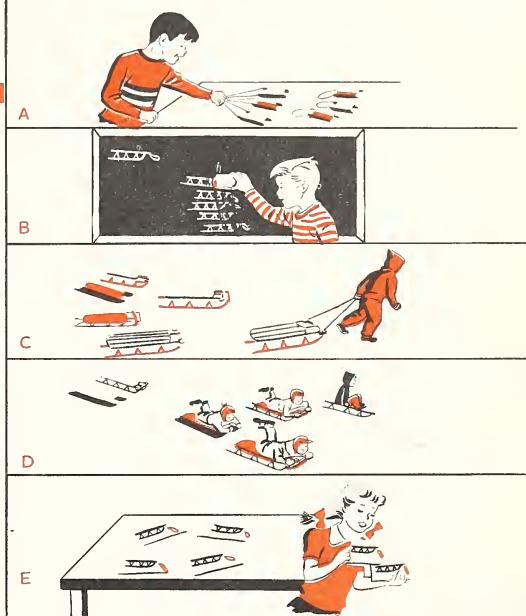
3 Have the children find and identify, in the same way, the white pictures that show the remainders for Pictures B to E.

43

Tell the children to read the first sentence, find the picture that illustrates it, and write the letter of the sentence in the brown response space in front of the sentence. They should then write the answer on the brown line in the sentence.

Have the children follow the same procedure for each sentence on the page. Point out that they will have to look at each picture more than once.

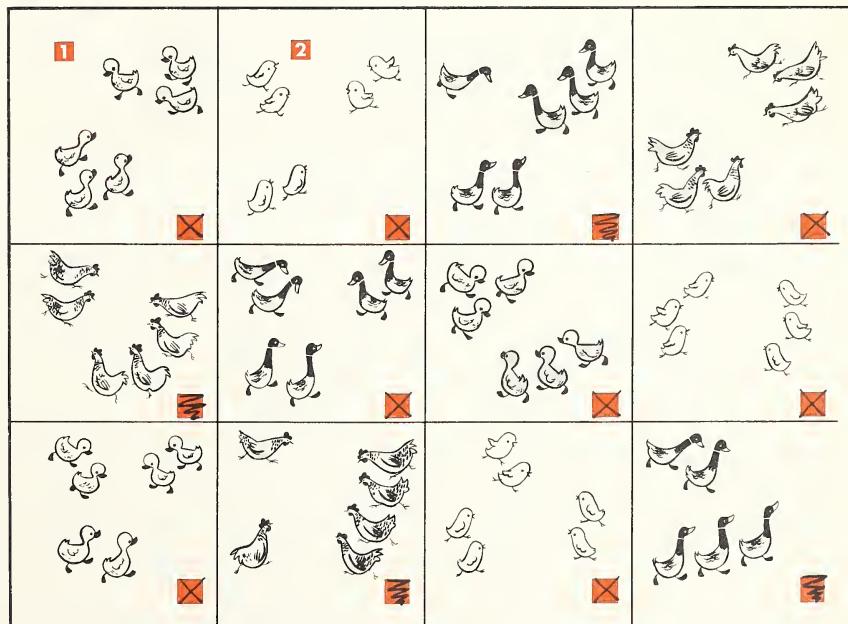
- D 6-4 equals 2 **1**
 C 6 sleds minus 1 sled equal 5 sleds. **2**
 A 6 minus 3 equals 3.
 B 6 sleds minus 5 sleds equal 1 sled.
 D 6 sleds minus 4 sleds equal 2 sleds.
 B 6-5 equals 1.
 C 6 minus 1 equals 5.
 E 6-2 equals 4.
 A 6-3 equals 3.
 E 6 minus 2 equals 4.
 D 6 minus 4 equals 2.
 E 6 sleds minus 2 sleds equal 4 sleds.
 C 6-1 equals 5.
 B 6 minus 5 equals 1.
 A 6 sleds minus 3 sleds equal 3 sleds.

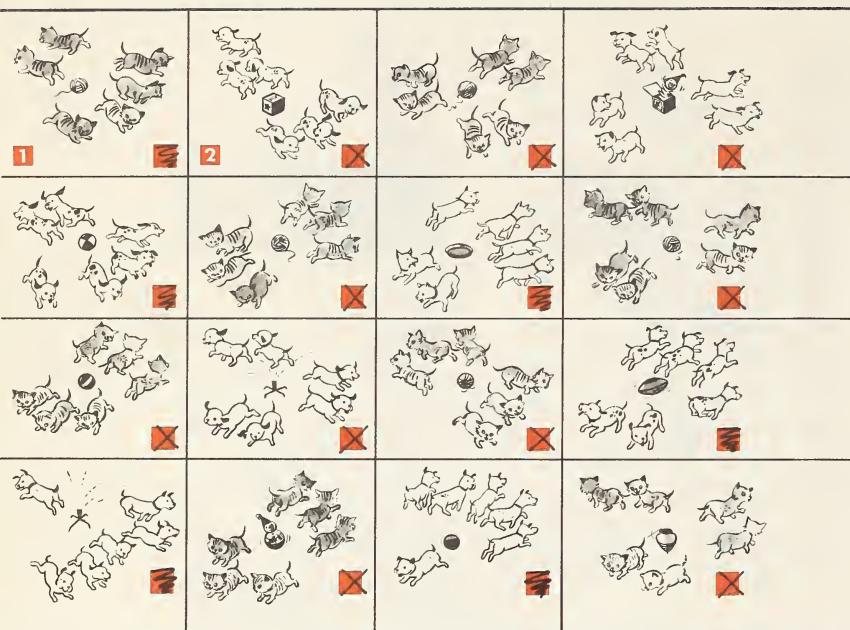


44

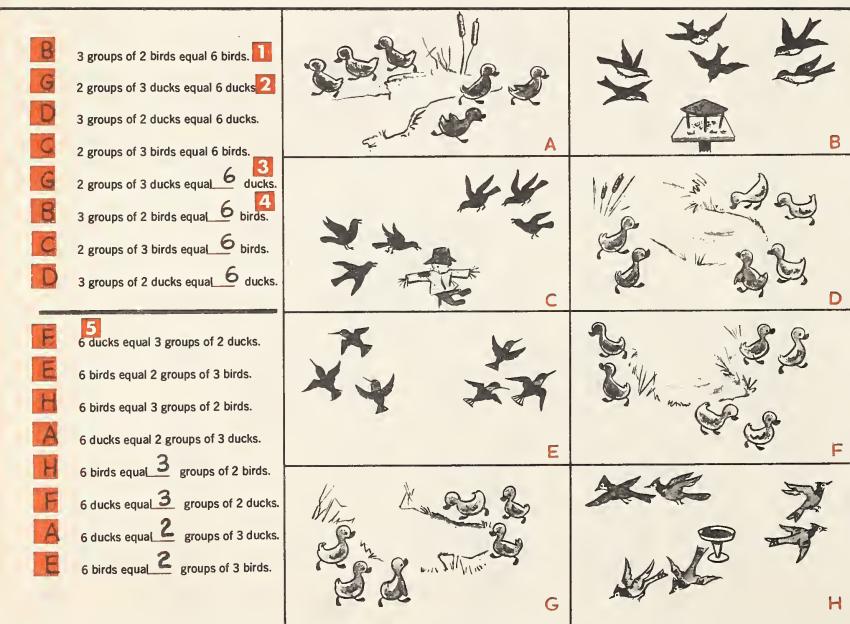
Tell the children to decide whether the groups of ducks that are coming together are equal or unequal. If the groups are equal, the children are to make an X in the brown response space in the picture; if they are unequal, they are to make scribble mark (⤒) in the response space.

Have the children follow the same procedure for each picture on the page.





- Tell the children to decide whether the kittens are going away in equal groups or in unequal groups. If the groups are equal, the children are to make an X in the brown response space in the picture. If the groups are unequal, they are to make a  in the response space.
- Have the children follow the same procedure for each picture on the page.

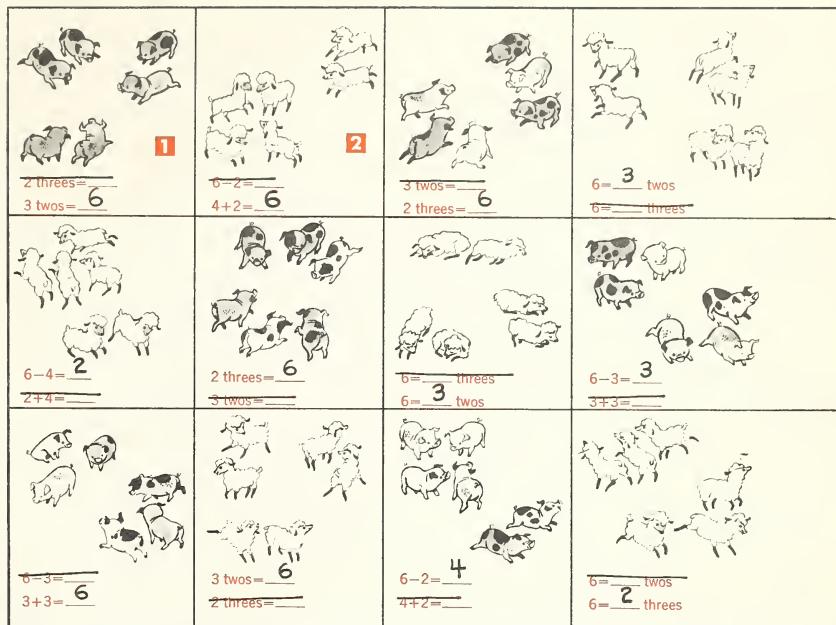


- Explain that the eight sentences above the gray line tell about equal groups that are coming together. Tell the children to read the first sentence, find the picture that belongs with it, and write the letter of that picture in the brown response space.
- For each of the next three sentences, use Note 1.
- Have the children find the picture that belongs with the fifth sentence and write its letter in the brown response space, then write the correct numeral on the brown line.
- For each of the next three sentences, use Note 3.
- Adapt Notes 1-4 to these separating situations.

47

Call attention to the first picture. Have the children read the two sentences and decide which one belongs with the picture. Tell them to cross out the sentence that does not belong. Then they should write the correct numeral on the answer line.

Have the children follow the same procedure for each picture on the page.



48

Call attention to the first picture. Have the children decide which of the two sentences belongs with the picture. Tell them to cross out the sentence that does not belong. Then have them write the correct numeral on the answer line.

Have the children follow the same procedure for each picture on the page.



| | | | | |
|----------|--|--|----------|-----------------------|
| 1 | | | 2 | |
| | | | | A 3 twos = <u>6</u> |
| | | | | B 5-4 = <u>1</u> |
| | | | | C 2+3 = <u>5</u> |
| | | | | D 5-3 = <u>2</u> |
| | | | | E 2+4 = <u>6</u> |
| | | | | F 7-1 = <u>6</u> |
| | | | | G 3+3 = <u>6</u> |
| | | | | H 1+1 = <u>2</u> |
| | | | | I 4+3 = <u>7</u> |
| | | | | J 7-6 = <u>1</u> |
| | | | | K 3-1 = <u>2</u> |
| | | | | L 6-5 = <u>1</u> |
| | | | | M 2 threes = <u>6</u> |
| | | | | N 6-2 = <u>4</u> |
| | | | | O 7-2 = <u>5</u> |
| | | | | P 1+5 = <u>6</u> |
| | | | | Q 5-1 = <u>4</u> |
| | | | | R 1+1 = <u>2</u> |
| | | | | S 7-4 = <u>3</u> |
| | | | | T 6-1 = <u>5</u> |
| | | | | U 1+5 = <u>6</u> |
| | | | | V 4+2 = <u>6</u> |
| | | | | W 3+3 = <u>6</u> |
| | | | | X 6-2 = <u>4</u> |
| | | | | Y 1+6 = <u>7</u> |

1 Call attention to the pictures on this page. For each tell the children to decide which sentence belongs with the picture and cross out the sentence that does not belong. Then they are to write the correct numeral on the answer line.

2 Have the children write the correct numeral on the green line in each exercise in the three columns. Be sure they understand that no pictures accompany these exercises.

50-55 MEASUREMENT

Objectives

The need to measure occurs often in daily life: in school, at play, and at home. All types of measurement share a common set of principles, the most important of these being the need for standard units. Children can best appreciate this principle if they are first taught that any convenient measuring object (a stick, a piece of string, a cup, a tin can) may be used to determine the approximate length or capacity of an object. Once the children grasp the basic idea of using the same unit a number of times, they can see the desirability of having standard units for ease in making comparisons.

In addition to accepting the desirability of standard units of measure, the child must learn to use the com-

mon measuring tools properly. He should also come to recognize the inexact nature of measurement, and he must learn to express measures as "a little more than" or "a little less than" the object he is using as a unit.

In the introduction to measurement in the following pages, the child learns first to apply several examples of the same nonstandard unit to the object to be measured and to count the number of these units he used. Then he learns to apply one unit (a stick, for example) over and over to the object to be measured, counting the number of times he had to use it. After these experiences, the child learns to use a foot ruler that is marked in inches to measure objects shorter than 1 foot or longer than 1 foot. He also becomes acquainted with pint and quart containers and the relationship of the pint to the quart.

The inch, foot, pint, and quart come within the ordinary experiences of children so often that it is natural to use them to introduce the idea of standard units. Many children may be familiar with the yard and the gallon, but systematic instruction on these and other common units may be deferred to later grades.

Although children in the primary grades are expected to learn how to tell time by the clock and how to use a calendar, no worksheets on these topics are included in *Our Number Workshop 2*. In the opinion of the authors, the telling of time by the clock and the calendar should be a daily classroom activity and should not be taught in isolated lessons.

Preliminary Teaching

Before the child uses Worksheets 50-55, he should learn to measure dis-

ances by laying several sticks all of the same length (or other appropriate nonstandard units) end to end and counting the sticks. Then he should learn to put down the same stick repeatedly, counting the number of times he does this. He should also learn to recognize when a distance is an exact multiple (for all practical purposes) of the measuring unit, and when it is more than or less than a multiple of the unit. The child should see also that the same principles he learned in connection with the measurement of length may be applied to the measurement of capacity.

When the children have had practice in using these basic measurement ideas, they are ready to learn about standard units of measurement, such as the inch, the foot, the pint, and the quart.

Provide each child in the class with 5 sticks or narrow strips of cardboard, each 2 inches long. Each child should also have 2 markers to show the beginning and end of various distances that he will measure with his sticks. You will also need an assortment of sticks of many different lengths from 2 inches to about 2 feet. The children will use these to discover that measurements made with a unit of a certain length do not agree with measurements made with a unit of a different length.

Begin by asking the children if they ever wanted to know how far away something was or how long something was. Let them tell about their experiences. Try to find out how they would go about measuring something. Children who have had previous experience with measurement may suggest the use of a stick, or even a ruler or measuring tape. If no one suggests a measuring unit, do not mention it until actual work with measurement begins.

First, provide several sticks or dowel rods about 5 inches long [any

convenient length will do] and let the children take turns applying a stick to chalkboard erasers, books, crayons, or other small objects to see if they are as long as, shorter than, or the same length as the stick. The purpose of this activity is to develop the children's skill in manipulating a measuring instrument. [Rulers should not be used for this purpose. It is important to show the children that length can be measured without reference to feet and inches.] Be sure the children place the stick so that one end of it coincides with one end of the object they are measuring, and so that the stick is held firmly against the edge of the object in a straight line.

Next, using several sticks or dowel rods about 15 inches long [any convenient length will do, but be sure the sticks are all the same length], let the children take turns measuring the length of the window sills, the width of the door, the length of the chalkboard, etc. Have them place the sticks end to end along the edge of the object they are measuring and count the number of sticks they use. Be sure the children place the sticks in a straight line, end to end, with no gaps between the sticks and no overlapping. Each time a child measures an object, have him describe the length, using such terms as "a little longer than two sticks," "not quite three sticks long," etc.

Now give each child 5 two-inch sticks and two markers. First let the children practice measuring books, sheets of paper, crayon boxes, etc., until they can easily place the small sticks end to end in a straight line. Then let them measure those objects and compare the various measures. For example, have each child measure the width of his own reader to see if all the readers are the same width; or have each child measure the width

of a book from the bookshelf to see whether it is wider or narrower than his reader. Then have the children put one of the two markers slightly to one side of their desks; give such directions as: "Put your other marker three sticks away from the first. Now put it five sticks from the first. Be sure the sticks are in a straight line."

To teach the children how to measure length by using the same measuring unit repeatedly, you can use sheets of paper that have been ruled off in advance. The rules should extend the full width or length of the paper and should be about 2 inches apart. Paper $8\frac{1}{2}'' \times 11''$ is easy to obtain and to handle.

Give each child 2 two-inch sticks and a sheet of the ruled paper. Now ask the children to use their sticks to measure the length of the first line at the top of the paper. When they discover that they need more sticks, ask them if they can think of any way to measure the line, using only the sticks they have. Let the children discuss the problem until one of them suggests using the same stick over and over. If necessary, help them by asking questions like: "Are the sticks the same length? Could we use just one stick over and over? How would we know exactly how many times the stick has been put down? How would we know exactly where to put it each time?" Show the children how to measure the line by putting down one stick, making a mark at the end of it, and putting the stick down again with one end touching the mark. Watch to see that they put the stick against the marks and keep the stick on the line. When they have finished, let them count the spaces between the marks to see how many times they put the stick down.

Next, give such directions as: "Now go to the next line on your paper. Make a pencil mark just three sticks

from the edge of the paper. On the next line make a pencil mark a little more than two sticks from the same edge. Now move the stick down to another line and make a mark a little less than three sticks from the edge." Let the children compare their marks and discuss any differences they find. Try to get them to develop judgment about "a little more than" and "a little less than."

It is important for the children to understand that they cannot talk to each other about measuring lengths or distances unless all are using the same measuring unit. Give several of the children in the class sticks of various lengths. Have them measure some of the same things that were measured in previous activities. Have them compare their results. Ask why one child says the table is five sticks long, another says it is two sticks long, another not quite three sticks long, etc. If necessary, ask the children if they think that some of them did not measure accurately. Repeat this procedure with several objects and sticks of different lengths. Continue the discussion until the children show that they understand why it is necessary to use a common unit of measure if two measures are to be compared.

[Worksheets 50 and 51 can be used at this point.]

In the following activities, the children learn that the inch and the foot are standard units of measure and that there are 12 inches to the foot. They practice using a foot ruler marked in inches to measure objects shorter than or longer than 1 foot.

The words *inch*, *inches*, *foot*, and *feet* should be introduced orally and then taught as reading words. Use the regular reading procedures.

Provide each child with 12 sticks or cardboard strips, each 1 inch in length. Have ready a collection of easily measured objects that are less

than 1 foot long. Suitable objects might be small books, crayons, or chalkboard erasers. Also prepare a number of cards or sheets of paper on which you have pasted or drawn pictures of things that have at least one straight edge (one picture to a card). Try to get some pictures with straight edges $1\frac{1}{2}$, $2\frac{1}{2}$, or $3\frac{1}{2}$ inches long. Pictures of boxes, combs, umbrellas, envelopes, houses, golf clubs, automobiles would all be suitable.

To begin, ask the children if they have ever heard the word *inch*. Let several of the children tell what they know about the word. If no one in the group is familiar with the idea of measuring in inches, explain that children's heights are often measured in inches. Explain that each of their little sticks is 1 inch long. Throughout the following activities, try to establish the fact that the word *inch* is used and understood by everyone because it always means the same length or distance.

Continue by having the children use the one-inch sticks to measure the short edge of their Number Workshops, their crayon boxes, their readers, new pencils, or any other objects with straight edges. This is to demonstrate to the children that when they measure similar things with a standard unit (the inch), they all get the same answer. Start with objects that are less than 3 inches long [if necessary, give the children little toy cars or other small objects that are all alike]. Say: "Use a stick to find out how long your little car is. How long is it? What do you have on your desk that is longer than the car? [Let a child select something. Be sure it is less than 12 inches long.] Now I want each of you to measure the front edge of your Number Workshop. Place sticks end to end to find out how long it is. Use as many sticks as you need. How long is each stick?"

How many sticks did you use? The edge of your Workshop is how many inches long? Did everyone get the same answer?" Continue in this way, letting the children measure objects on their desks.

Then give each child several of the cards on which you have pasted pictures. Tell the children to select one card and measure the object pictured on it. Say: "John, tell us what picture you chose. How long is it? Did anyone else measure a picture of a toothbrush? How long is it? Are the two pictures the same length? Did anyone else measure something that is 6 inches long? What is it? Did anyone measure something that is about 4 inches long? What is it? Is its length a little more or a little less than 4 inches? Look at the pictures on your desk and see if you can find two that you think are nearly the same length. Measure each of these pictures. What two pictures did you measure, Mary? How long was each?"

Continue in this way, while the children measure each of the remaining pictures on their desks. Then have them exchange pictures and continue measuring while you teach them to discriminate between situations described by "a little more than 2 inches" and those described by "a little less than 3 inches." Try also to get them to recognize when an object measures just midway between 2 inches and 3 inches (or 1 inch and 2 inches). Some children may mention half of an inch, but do not expect them to understand fractions of an inch.

Interest the children in drawing lines (freehand) that are 1 inch long. Have one child draw a line and let another measure it with a one-inch stick. All the children should take turns. This practice should be continued frequently throughout the year.

Now give each child a foot ruler with the inches marked. Do not use

rulers showing divisions of the inch, since these subdivisions are confusing to young children. If rulers of the type just described are not available, you can make cardboard rulers without much trouble.

Explain to the children that each little section marked on the ruler is 1 inch. Have the children lay their one-inch sticks end to end along their rulers, counting as they do so. Then tell the children that 12 inches make a foot. Explain that the foot ruler is used to measure longer objects, which are hard to measure with one-inch sticks. Encourage the children to suggest objects in the room that can be measured in feet. Now put a collection of objects less than a foot long on a table and let the children take turns in selecting an object and measuring its length. Teach them to read the measures from the ruler in inches, expressing their judgments as "a little more than 5 inches," "a little less than 7 inches," "between 8 inches and 9 inches," etc.

Now have them use their rulers to measure longer objects in the room (desks, tables, window sills, etc.) and give the measures in feet. This should be a group activity, since more than one ruler will be needed. One child can place the rulers, another decide on the length, and so on. As in the work with inches, encourage such responses as "a little more than 3 feet," "almost 2 feet," "between 4 and 5 feet," etc.

Show the children how to measure a rather long distance—for example, the length of the room or the distance between two chalk marks on the floor. For this activity supply two children with enough rulers to cover the entire distance when the rulers are laid end to end. Let them count the rulers and learn that the number of rulers tells how many feet long the distance being measured is. Be sure that they

put the rulers down in a straight line, neither overlapping them nor leaving gaps between them. Then let another pair of children measure shorter distances on the floor. These children should use only one ruler and make a chalk mark at the end of it each time they put it down. They should keep a tally of the number of times they put the ruler down, and then verify their result by counting the spaces shown by the chalk marks on the floor.

Encourage the children to take home a piece of paper one foot long and measure some selected object around the house—the table they eat at, for example. Suggest that each child find a ruler at home and see if it is the same length as his own ruler. Let the children discuss the measuring they did at home. Ask several children to show on the classroom floor the length of the table at home. Encourage them to compare the different lengths of these tables. Always stress that it is possible to compare lengths only when they are measured in the same unit.

[Worksheets 52 and 53 can be used at this point.]

Careful preliminary teaching is necessary before Worksheets 54 and 55 are used. The same basic steps that were used to prepare the child for understanding linear measurement should be used for the measurement of capacity. First the child uses a single measuring model once for each quantity measured. Then he uses more than one copy of the model. He measures to find out if one quantity is more than or less than another quantity; then he measures a given quantity of material by using one model repeatedly. Finally, he learns to recognize situations in which he cannot tell whether one quantity is greater than another quantity.

Two kinds of materials are needed for the activities which follow: sub-

stances to be measured and containers with which to measure them. The most convenient substances to measure are rice and dried peas, beans, or corn. Liquids and sand are likely to be troublesome in the classroom and should be avoided. Small wooden beads can be used if a sufficient quantity is available. There should be a variety of containers of different shapes and sizes. Some should be equal in capacity but different in shape; some should be alike in shape and capacity; and some should be unlike in shape and capacity. Milk bottles, fruit and pickle jars, berry baskets, pitchers, and boxes are all suitable. Be sure to have some pint and quart containers.

Start by discussing with the children how different kinds of food are bought. For example, some things are bought by the dozen, some by the package, some by the pound, and some by the pint or quart. Point out that packages come in standard sizes—that every package in a grocery store is not a different shape and size, but that many foods come in packages of several different sizes. Do not attempt to explain to the children what a pound or a pint or a quart is. Be sure the children understand, however, that people buy things by the pound or by the quart so that they will know how much of something they are getting. Lead the discussion to things that are bought by bulk. Ask the children how they know that each time they buy a quart of milk they get the same amount of milk. When they say that the bottles are all the same size, ask them if the bottles are always full, and if they could be sure that each bottle had the same amount if they were not full.

Then ask the children if they have ever seen both cartons of milk and bottles of milk in the same store, and how they can be sure that these dif-

ferent containers hold the same amount of milk. Show them an empty milk carton and an empty milk bottle (both quarts). Ask them if they can think of any way to find out if the two containers hold the same amount. Fill one of the containers with rice or dried beans. Get the children to suggest pouring the contents of one container into the other. If possible, have two or three other containers of different sizes. Taking each container in turn, ask the children if they think it will hold the same amount as the milk carton. Then let them discover whether the containers hold more than, less than, or the same amount by pouring the contents of the milk carton into each of them.

Next, have on hand a number of containers that are alike in shape and capacity. They may be pint bottles, berry baskets, or boxes of the same size and shape. First, fill the containers and divide them into two unequal groups. Ask the children which group of containers holds the greater amount. They should understand that three full boxes hold more than two full boxes, if the boxes are alike. Then vary the amounts in the boxes, and let the children try to decide which group holds the greater amount when all the boxes are not full. Let them test their judgment by redistributing the material in the boxes to fill as many boxes as possible in each group.

Partly fill two containers that are different in size and shape, and let the children guess which contains the greater amount. Let them measure by pouring the contents into smaller containers that are alike in shape and capacity. Continue these activities until the children understand that they must consider the size and shape of the containers, the number of containers, and the quantity of material in each.

[Worksheet 54 can be used at this point.]

Next, the children should get some experience in using a single measuring unit over and over. Ask one of the children to pour a cupful or glassful of rice or dried peas into each of two containers of different size. Ask the other children if each container holds the same amount, and how they know. Then say: "Put two more cups of rice into this jar. Now put three more into this jar. Do both jars still hold the same amount? Which holds more? How do you know?"

Fill two containers of different size and shape, and ask the children to guess which holds the greater amount. Then let them use a smaller container to measure the amount in each. Be sure they fill the smaller container to the same level each time, and emphasize that if they do not, the measurement will not be accurate. Ask them to guess how many cupfuls a container will hold, or which of two containers will hold more. Then let them use a cup measure to find out. Pour three cupfuls of beans into one jar and three glassfuls of beans into another, and ask the children if each jar has the same amount of beans in it. They should understand that the unit of measure as well as the number of times it is used must be the same if the jars are to have the same amount of beans.

Continue with activities similar to those suggested above until you are sure the children understand that capacity can be measured by using the same unit over and over and counting the number of times it is used, if it is always filled to the same level. Make sure that each child has an opportunity to measure. Develop the idea that capacity cannot be judged by the shape of the container.

Ask the children to tell you something that is bought by the pint or

quart. Find out if they know what a pint and a quart are used for. Try to get answers that show the children understand that the pint and quart are standard units for measuring such things as milk, orange juice, ice cream, berries, etc. Do not try to distinguish between liquid and dry measure. Stress the convenience of measuring in pints and quarts (because everyone becomes familiar with these amounts). Show some pint and quart containers. Ask the children if they can tell which are pints and which are quarts. Ask if a pint bottle or carton holds as much as a pint jar. Demonstrate the equal capacities by pouring the contents from one pint container into another pint container of a different shape. Explain that there are two pints in one quart. Demonstrate this fact also, several times and in different ways. Pour the contents of a quart container into two pint containers, the contents of two pints into a quart, the contents of the quart back into two different pints, etc. Each time, ask the children questions requiring the answer that there are two pints in a quart or that a quart will fill two pints.

Line up several quart containers on the table. Tell a child to put containers that would hold the same amount in front of each quart. Have enough pint containers available so that two can be put in front of each quart and some will be left over. The child should set up a two-to-one correspondence between the pints and quarts.

Now let the children use the containers and the measuring material (beans, beads, etc.) to show to their own satisfaction that the contents of one quart really will fill two pints. They should have much practice in measuring with pint and quart containers to help them form a fairly accurate idea of the amount represented by each of these measures.

Finally, put different amounts of material in several large, differently shaped containers and let the children measure these amounts with pint and quart containers. Work for responses indicating judgment, such as "more than 2 pints," "a little more than a quart," "a little less than 3 pints," etc. You may vary this activity by asking different children to measure out given amounts of material, such as "3 pints," "2 quarts," "4 pints," and a "quart and a pint."

[Worksheet 55 can be used at this point.]

50 Comments

On this page the child uses a two-inch stick repeatedly to measure the lengths of various line segments. He learns to distinguish between distances that are, for all practical purposes, multiples of a nonstandard unit and distances that are a little more than or a little less than exact multiples of it.

Provide each child with a two-inch stick. If the activities suggested in the "Preliminary Teaching" section have been used, no special activity will be needed to introduce the page. Tell the children to turn to Worksheet 50, and let them examine the page.

Let the children discuss the pictures, and ask what they think they are to do. Tell them to imagine that each vehicle has traveled the entire length of the green line it is standing on. Ask the children how they can tell the beginning and the end of each green line. Be sure they notice that another picture of each vehicle appears at the bottom of the page, followed by an answer line and the words more and less. Give them directions, and work through the first exercise with them. When they have finished the work on the page, let them discuss and compare their answers.

51 Comments

In most daily activities, measurement is used for two different purposes. Either we measure to find out how long or how high or how wide something is, or we measure to find a given portion of something. For example, we measure to find out how tall a person is, how long or how wide a room is, or how long a table is. We also measure three yards of dress material so that it may be cut from the bolt, four- or five-foot lengths of board to be cut for shelves, or fifty feet of wire for a fence.

On this page the children get their first practice in measuring to find certain lengths on lines provided on the worksheet. Some of these lengths are multiples of the length of the measuring stick; some are more than or less than a certain multiple of the length of the stick. The phrase printed above each green line tells the distance the children are to measure on the line. Have them use a pencil to make a mark at the end of the stick each time they put it down, and a colored crayon for the mark that shows the distance indicated by the phrase above the line. For example, on the first line, where the phrase reads "more than 2," there should be two pencil marks (showing that the measuring stick was put down twice) and a crayon mark a little beyond the second pencil mark. On the second line, where the phrase reads "less than 1," there will be one pencil mark, showing that the stick was put down once, and a crayon mark a little to the left of it to indicate a length a little less than the length of the stick.

To introduce this page, draw several lines of different lengths on the board. Write a phrase over each one like the phrases on page 51. Use a stick that is long enough for the

children to see easily and show them what you mean by "a little more" and "a little less" than the length of the stick. Ask a child to read the first phrase. Measure off that number of lengths of your measuring stick on the line under the phrase. Use white chalk to mark the end of the stick each time you put it down. Let the children tell when you have put down the stick the correct number of times. Then let them decide what a little more or a little less than that length might be. At that point make a mark on the line with colored chalk. Repeat these procedures until you have measured off all the distances indicated by the phrases on the board.

Tell the children to open their books to page 51 and let them discuss the page. Have them tell what they are to do. Remind them to use a pencil to mark the end of the stick each time they put it down, and a crayon to make the mark that shows the distance asked for by the words above the line. Be sure each child has a two-inch stick, a pencil, and a crayon. Work through the first exercise with them. With a group of slow learners, it may be necessary to work through several of the exercises.

When the children have finished, let them compare and discuss their answers.

52 Comments

On this page the child uses for the first time a standard measuring unit (the inch) to measure objects that are less than 1 foot long.

Each child will need a one-inch stick for these exercises. First, establish to the children's satisfaction that the sticks are exactly 1 inch long. If the activities suggested in the section on "Preliminary Teaching" have been used, the children should understand what an inch is. Let them com-

pare their one-inch sticks with the inches on their rulers or on the room yardstick.

To introduce this page, give each child a strip of paper. These strips may vary in length from about 3 inches to about 8 inches. Show the children how to fold the paper and cut a row of connected paper dolls, or other simple forms like those on page 52. When they have finished, let each child measure his strip. Then tell the children to trade their strips and compare the lengths of the cutouts. Have each child try to find cutouts that are a little longer or a little shorter than his own, as well as some that are the same length. Have the children make statements like: "My cutout is 4 inches long. John's is a little more than 4 inches long," or "My cutout is a little less than 5 inches long. John's is just 5 inches long." Write several of these measures on the board, and be sure the children can read them easily and with understanding. Then tell them to turn to Worksheet 52.

Ask the children to measure the top strip of paper dolls. Direct their attention to the expressions (A to O) in the upper right corner of the page. Have them find the expression that tells how long the top strip is [J], and explain that they are to write the letter J in the response space to the left of the dolls. Try to get the children to observe how the expressions are organized ("1 inch," "more than 1 inch," "less than 1 inch," "2 inches," "more than 2 inches," "less than 2 inches," etc., through "less than 5 inches"), so that it will be easier for them to find the one they are looking for. Explain that the same expression might be used for more than one strip of cutouts, because there might be several of the same length on the page, and that there might be some expressions that they do not use at

all. [J is used twice, and E, H, and I are not used at all.]

With a slow group of children, it may be necessary to work through several of the exercises. When the children have finished the work on the page, let them compare and discuss their answers.

53 Comments

On this page the child learns that the foot is a standard unit of measure, and he uses a foot ruler marked in inches to measure lengths less than 1 foot.

The exercises on this page are similar to those on page 52, except that the children measure with a foot ruler. They respond in each exercise by writing the appropriate number of inches on the answer line in one of three expressions.

Each child should have a foot ruler, marked only in inches. If such rulers are not available, you may provide strips of cardboard, each 12 inches long, marked in inches. You may wish to let the children compare their rulers and find out that they are all the same length.

Introduce the page by asking the children to turn to Worksheet 53. Permit them to discuss the worksheet for a few minutes. Then ask what they think they are going to do on this page. Have them measure several of the pictures while you watch to be sure they are using their rulers properly. Get them to observe the three expressions below each picture. Explain that for each picture they are to select the most appropriate expression and write the correct numeral on the answer line.

Work through several of the exercises with the children if you have a slow group. When they have finished, let them compare and discuss their work.

54 Comments

On this page the child learns that one cannot judge volume unless the containers are the same size and shape or unless there is a big difference in the size or number of containers holding the volumes that are being compared.

To make the judgments required by the exercises on this page necessitates careful consideration. First, the children must observe a key picture and note the size, shape, and number of containers. They also must note whether these containers appear to be full or only partly full. Then they must compare the contents of these containers with the contents of containers in other pictures. They must decide whether the total quantities shown in each of these other pictures are greater than, less than, or equal to the total quantity shown in the key picture, or whether it is impossible to tell. Remind the children that many small but full containers might hold more than one large and full or partly full container; and that if two containers seem to be nearly the same size, but are different in shape, it is impossible to be sure which container will hold more.

When the children have finished the work on this page, they should have developed some judgment in comparing volumes and should also realize that at times it is impossible to compare volume except by actual, accurate measurement. Be sure no child feels that there is anything incorrect in the "cannot tell" response in those cases where accurate judgment is not possible.

If the activities suggested in "Preliminary Teaching" have been used, no other special activity is needed to introduce the page. Be sure the children understand that the response for each exercise has two parts. First,

hey must decide and indicate by a response mark whether or not they can reasonably compare two volumes. Second, they must either cross off all three words in the exercise, or encircle one of them to express the comparison they are making and cross off the other two.

Most groups of children will find this page interesting, and will enjoy making independent decisions as soon as they understand what to do and how to respond. The slower children may not be able to do the work on this page without help. If it is obvious that they cannot do any of the exercises independently, work with them for at least one period, discussing thoroughly as many of the exercises as you can get through in that time.

It is important to conclude the work with a discussion of the chil-

dren's responses, with particular emphasis on those that differ.

55 Comments

On this page the child learns that 1 quart is equal to 2 pints and has experience in replacing 1 quart by 2 pints and replacing 2 pints by 1 quart. He also works exercises that necessitate such replacements before he can add or subtract.

If the activities suggested in "Preliminary Teaching" have been used, no special activity is needed to introduce the work with the pictures at the left of page 55.

Before the children try to work Exercises A to Q, write a number of similar sentences on the board and work through them with the children. Remind them that in each exercise the first thing to do is to observe

whether the answer should be in pints or in quarts. In several exercises on the worksheet they cannot find the answers until they have this information. If necessary, show them how to convert one measure to the other before they perform whatever operation is called for by the exercise. See that each child has a sheet or two of paper to use if he needs it.

The slower children may need to use markers to work out some of these exercises. Give them 12 small markers each and tell them that each marker stands for 1 pint. Thus, a group of 2 markers stands for 1 quart. Show them how they can use the markers to work out the equivalents.

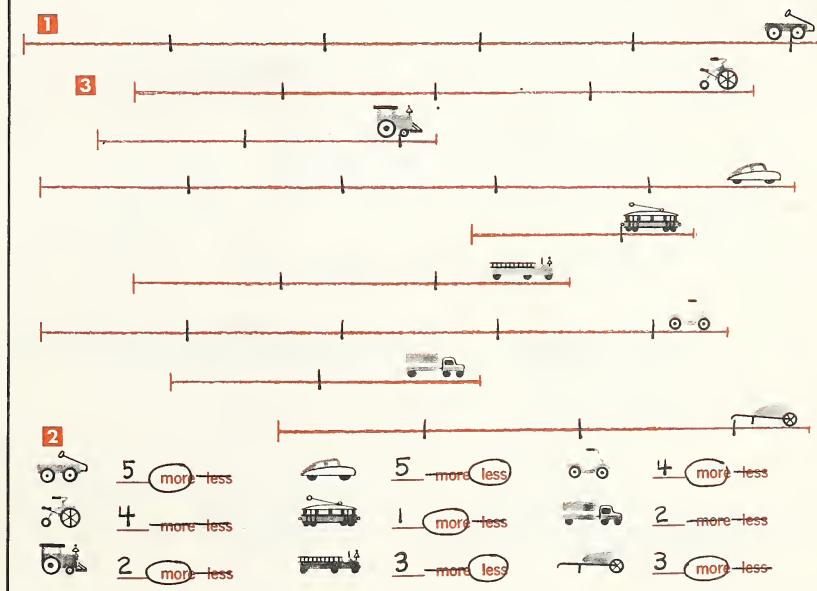
Let the children compare and discuss their answers when they have finished the work on the page.

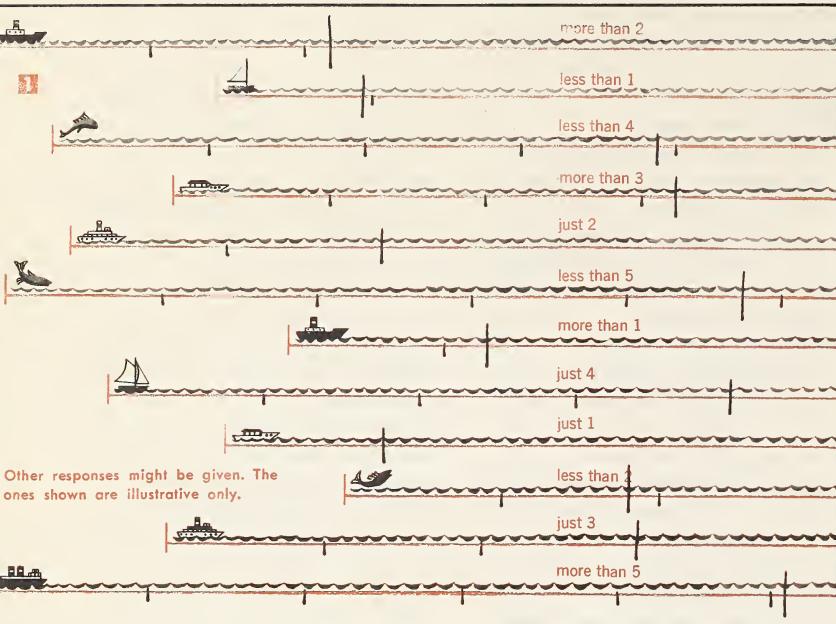
50

1 Tell the children to put a two-inch tick on the first line so that one end touches the mark, and make another line, and to make a pencil mark at the other end of the stick; then put the stick down so that one end touches the mark, and make another mark; then repeat this process to the end of the line.

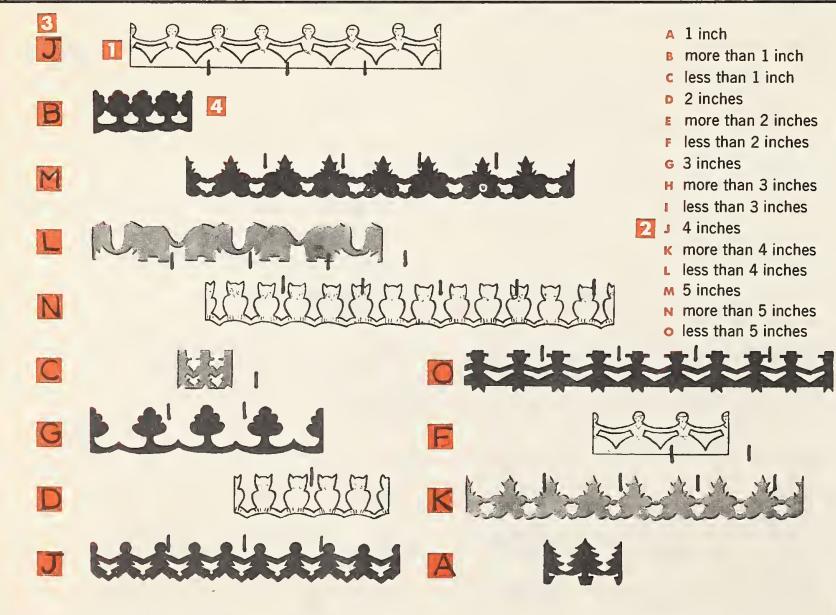
2 Tell the children to count the number of times they put the stick down and write the numeral on the answer line beside the wagon at the bottom of the page. If the distance is more than is indicated by the numeral, have them encircle the word *more* and cross out the word *less*. If the distance is less, they should encircle *less* and cross out *more*. If the distance is just a multiple of the length of the stick, they should cross out both *more* and *less*.

3 Use Notes 1 and 2 for each line.





- 1 Use the procedure described in "Comments" for this page. Give each child a two-inch stick. Remind the children to use both a pencil and a crayon in each exercise. Supervise their work on the first exercise, or on the first several exercises, if necessary. Let the children finish the exercises independently.



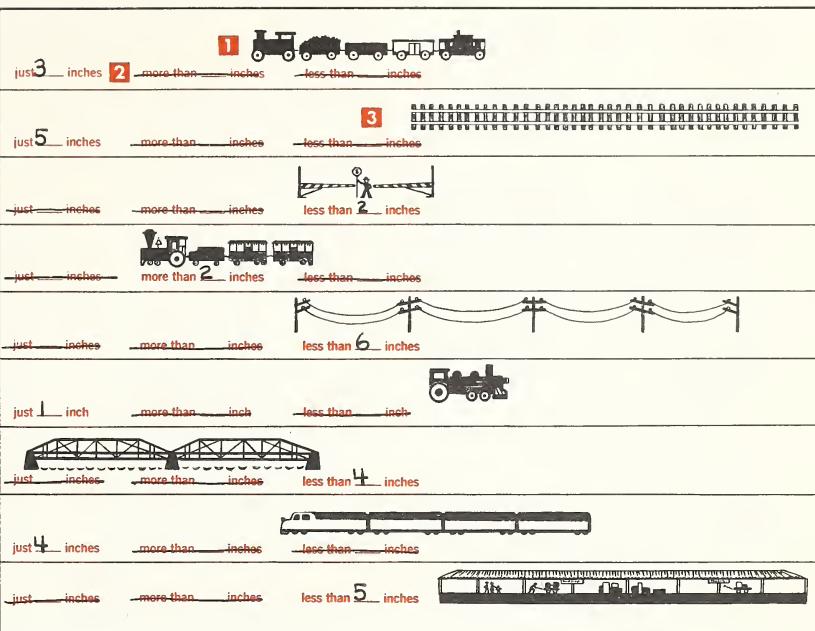
- 1 Give each child a one-inch stick. Tell the children to measure the top strip of paper dolls by placing the stick along the lower edge of the cutout, making a mark at the end of the stick, and using that mark as the starting point the next time they put the stick down.
- 2 Tell the children to find the expression that tells how long the cutout is.
- 3 Have the children write the letter for the expression in the response space at the left of the cutout.
- 4 Tell the children to follow the same procedure for each cutout on the page.

53

1 Give each child a foot ruler marked in inches. Show the children how to measure the train at the top of the page with a ruler.

2 Direct attention to the three expressions under the picture. Tell the children to decide which expression they should use for the answer and write on the answer line the numeral that tells how long the train is. Have them cross out the expressions they do not use.

3 Have the children follow the same procedure for each picture on the page. When they have finished, let them compare and discuss their answers.



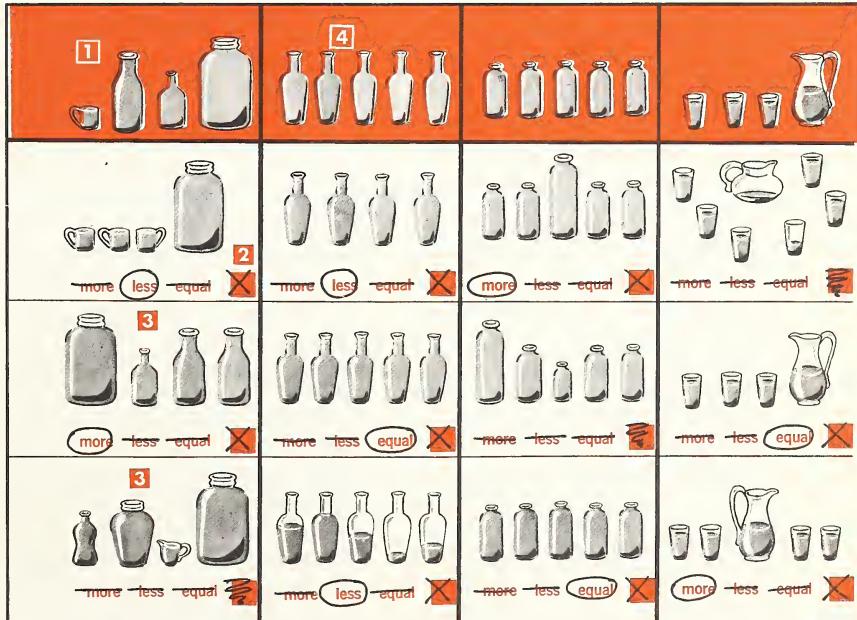
54

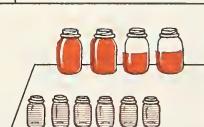
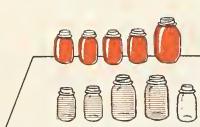
1 Direct attention to the first green picture and to the first white picture. Tell the children to put an X in the response space in the white picture if they can decide that the total amount of liquid shown in the white picture is more than, less than, or the same as the total amount shown in the green picture. If they cannot tell, they should make a scribble mark.

2 When they make the response X, they should select the word that belongs with the picture [less], draw a ring around it, and cross out the other two words. Tell them that when a scribble mark is put in the response space, all three words should be crossed out.

3 Tell the children to follow the same procedure for this picture.

4 Use Notes 1, 2, and 3 for each column of pictures.





- 3**
- A 3 quarts = 6 pints
 - B 2 pints = 1 quart
 - C 2 quarts plus 1 pint = 5 pints
 - D 6 pints = 3 quarts
 - E 2 quarts plus 2 pints = 3 quarts
 - F 2 groups of 3 pints each = 6 pints
 - G 1 quart plus 2 quarts = 6 pints
 - H 6 pints minus 1 quart = 4 pints
 - I 1 pint plus 1 quart = 3 pints
 - J 6 pints = 3 groups of 2 pints each
 - K 1 pint plus 1 pint = 1 quart
 - L 6 quarts minus 4 quarts = 2 quarts
 - M 5 pints minus 3 pints = 2 pints
 - N 1 pint plus 5 pints = 6 pints
 - O 2 quarts plus 3 quarts = 5 quarts
 - P 3 groups of 2 pints each = 6 pints
 - Q 2 pints plus 2 pints = 2 quarts
- 4**

56-58 COMPARISON BY SUBTRACTION

Objectives

One of the commonest problem situations is that in which two groups are compared to determine how many more are in one group than in the other. Traditionally, children were told to solve such problems by subtraction, but there was nothing in the situation to suggest the subtraction process. Now the child learns why he can subtract to solve comparison problems.

The only type of subtraction problem the children have encountered up to this time is one in which a group of objects is given, a subgroup is taken away, and the number of objects remaining is to be found—for example, "Betty had 5 puppies. She gave 3 away. How many are left?" The group of 3 puppies Betty gave

away is a subgroup of the group of 5 puppies.

The following is a typical example of a comparison problem that is solved by subtraction: "Betty has 5 puppies and 3 kittens. How many more puppies than kittens does she have?" The number of puppies is to be compared with the number of kittens. The group of 3 kittens is not a subgroup of the group of 5 puppies, and the child must be shown why he can subtract to get the answer. It is clear that 3 kittens cannot be subtracted from 5 puppies. In the solution a subgroup of the larger group equal to the smaller group is taken away from the larger group. The remainder tells how many more members are in the larger group than in the smaller. In this comparison problem, then, we can

1 Tell the children that each large jar in the pictures holds 1 quart and each small jar holds 1 pint. Direct attention to the first picture. Tell the children to color as many empty jars as they could fill from the full jars.

2 Tell them to proceed in the same way with the other pictures. Be sure they understand that if a jar can be filled only part way, it is to be colored only part way.

3 Give instructions for Exercises A to Q as suggested in "Comments." The children are to write each answer on the green line in the exercise.

4 Let the children compare and discuss their answers.

think in the following manner. As many puppies as there are kittens are taken away from the group of puppies. Two puppies remain. Therefore there are 2 more puppies than kittens.

The natural way for the child to deal with this situation is to make a one-to-one correspondence between the members of the two groups until all the members of one group have been used. The corresponding members in the larger group are the taken away, and the number of members remaining is determined. In solving the comparison problem that has been used as an example in this discussion, the child matches each of the 3 kittens with a puppy, takes puppies away from the group of puppies, and observes that 2 puppies are left. Then he knows that there are 2 more puppies than kittens.

The child who has been taught to solve comparison problems in this way understands why he can subtract to get the answer. He has combined two familiar ideas, one-to-one correspondence and subtraction, in a logical solution to a problem based on a situation in which the members of a group are being compared with the members of another group.

The analysis of comparison by subtraction given above is the basis for Worksheets 56-58 in Our Number Workshop 2 and for the activities suggested in the following "Preliminary Teaching" section.

Preliminary Teaching

Before using Worksheets 56-58, the children should use markers to solve comparison exercises (how many more in one group than in another group) by making a one-to-one correspondence between the members of one group and the members of another group, then taking away the smaller matched group to find how many more members are in the larger group.

Each child will need 14 markers, of one kind and 7 of another kind. Use markers that make it easy to distinguish between the two sets. For example, one set of markers can be red, and the other set can be blue. A collection of small objects, such as toy automobiles or airplanes of different colors, small dolls, blocks, tops, jacks, or beads, of which groups can be made and compared, should also be available.

Begin by asking the children if they have ever wanted to know how many more pennies one toy cost than another, or how many more marbles one child had than another. Let them talk about their experiences with "how many more," but try to restrict the discussion to comparisons of groups that can be seen and counted.

In the following activities, make sure the larger number of objects is 3, 5, 6, or 7.

Ask 5 boys and 3 girls to come to the front of the room. Call the children by name so that the number of children in each group is not emphasized. Ask the boys to stand in a group at one side of the room and the girls in a group at the other side. Ask the class if they can tell which is the larger group, the group of boys or the group of girls. Ask the children if they can tell without counting how many more boys there are than girls. Then ask if they can think of an easy way to show this. Try to get someone to suggest that each group line up in a row, with the 3 girls standing in front of 3 of the boys. An alternate acceptable suggestion is that a boy and a girl pair off until there are no more girls. Get them to see that in both cases they have made a one-to-one correspondence between all the girls and as many boys as there are girls. Tell the 3 boys to move away. Ask how many boys are left, and how many more boys there are than girls. Get the children to see that the same number of boys as there are girls (3) was taken away, or subtracted, from the group of 5 boys, and that the remainder (2 boys) shows how many more boys there are than girls.

Now distribute to each child two sets of 7 markers each. Have the children put a set on each side of their desks. Say, "Make a group of 6 red markers and a group of 2 blue markers. Can you see without counting how many more red markers than blue markers there are? Arrange the 6 red markers in a row. Now move a blue marker over to a red marker. Move the other blue marker over to another red marker. How many blue markers are there? Why did you move the blue markers over to the red markers? [Work for answers that show that the

children understand they matched the blue markers to red markers to make a group of red markers equal to the group of blue markers.] Now move 2 red markers away. How many red markers are left? How many more red markers are there than blue markers? How do you know? [Because the same number of red markers as blue markers was taken away. The red markers that are left show how many more red markers than blue markers there are.]

Repeat this activity with other groups—7 red markers and 2 blue markers, 4 red markers and 5 blue markers, etc. Through questions and discussion, get the children to understand why they make a one-to-one correspondence between the smaller group and the same number of members of the larger group. Be sure they understand that they take away from the larger group as many objects as there are in the smaller group, and why they can subtract to find how many more are in the larger group.

Next, let the children make up problems about the collections of small objects suggested at the beginning of this section. Let a child make up a problem, then select and manipulate the objects at a table. The other children can use markers at their desks to work out the action. Such problems might be: "There are 5 airplanes and 2 tops. How many more airplanes are there than tops?" "I have 6 green beads and 3 yellow beads. How many more green beads than yellow beads do I have?" Make sure that the child who is making up the problem shows both the matching and the subtractive action with the objects he selects.

As a child performs the action for his problem, he should describe it in somewhat the following terms: "I have 7 red cars and 3 yellow cars. I

am going to find out how many more red cars than yellow cars I have. I am matching each yellow car with a red car. Now I am going to take away as many red cars as there are yellow cars. [Or "Now I will take away 3 red cars because there are 3 yellow cars."] There are 4 red cars left. I have 4 more red cars than yellow cars."

Get the children to finish their demonstrations by stating the subtraction basic fact: "7 cars minus 3 cars are 4 cars. 7 minus 3 equals 4."

Continue with activities similar to those suggested above until the children know that "how many more" problems are solved by making a one-to-one correspondence between the smaller group and the larger group, then taking away from the larger group the same number of objects as are in the smaller group.

[Worksheets 56, 57, and 58 can be used at this point.]

56 Comments

On this page the child performs the actions necessary to understand how to solve comparison exercises ("how many more") by subtraction and completes expressions relating to the exercises.

The exercises on this page are different from any the children have worked with previously. Each picture shows two groups of animals or objects, the larger group printed in black and the smaller group in green. The children are to find how many more objects are in the larger group than in the smaller group. They are to complete the three expressions in each picture. The first step is to decide how many objects are in the larger group and complete the first expression. If possible, the children should do this without counting. The second step is to make a one-to-one

correspondence between the objects in the smaller group and part of those in the larger group, draw a ring around the matching objects in the larger group, and complete the second expression, which tells the number of objects to be subtracted from the larger group. Some children may need to put markers on the green objects and move them one by one to the black objects. They should understand that the number of objects they encircle is the number of objects they are going to subtract from the larger group. In these exercises the encircled group of objects is "taken away" or "subtracted" by crossing it out. The last step is to determine how many objects are left in the larger group and complete the third expression.

Introduce this page by working through with the children several situations like those on Worksheet 56. Give each child 14 markers, 7 of one color or kind and 7 of another color or kind. Draw two groups of simple, different objects on the chalkboard. They might be boxes and X's, apples and bananas, crescent moons and stars, etc. Write three expressions (like those on Worksheet 56) that apply to the groups you have drawn. Give directions like those in the keyed notes for Worksheet 56. (See page 71.) Let a child draw a ring around a group and write the correct numerals on the lines while the other children work with markers at their desks and give the answers verbally.

A transparent overlay can be used to check this page.

57 Comments

On this page the children continue to solve comparison exercises by subtraction.

Worksheet 57 is like Worksheet 56, except that the first expression in each picture on Worksheet 56 has

been omitted. The "Comments" for Worksheet 56 apply to Worksheet 57.

Introduce the page by telling the children that the work is like that for the preceding page, with the exception mentioned above.

If you are working with a slow group, let the children use markers to make a one-to-one correspondence between the members of the smaller group and part of the members of the larger group. If necessary, work through several of the exercises with the children.

A transparent overlay can be used to check this page.

58 Comments

On this page the children continue to solve comparison problems by subtraction. They are also required to write the subtraction basic fact involved in each exercise.

Worksheet 58 is like Worksheet 57, except that the children are to write in the space provided the numerals and signs that tell how to find "how many more." The "Comments" for Worksheet 56 apply also to Worksheet 58.

To introduce this page, draw on the chalkboard groups of objects like those suggested in "Comments" for Worksheet 56. Under two groups of objects, write two expressions like those on page 58, and draw a response strip between them. Then have a child draw a ring around the group that is to be taken away, write the correct numerals on the lines, and write the basic fact, while the other children work with markers at their desks. Repeat this activity until you are sure the children understand what they are to do on the worksheet.

A transparent paper overlay can be used to check this page.

56

Direct attention to the first picture. Tell the children to decide how many rabbits are in the picture and write the numeral for that number on the first answer line.

Have the children match each dog with a rabbit, then draw a ring around group of rabbits that is equal in number to the group of dogs. Next, tell them to take away the encircled group by crossing it out, then write the correct numeral on the second answer line.

Tell the children to find out how many rabbits are left (how many more rabbits than dogs) and write the numeral on the third answer line.

Have the children follow the same procedure for each picture on the page.

| | | |
|---|--|---|
| <p>7 rabbits in all Subtract 5 rabbits. 2 more rabbits than dogs</p> | <p>5 baskets in all Subtract 3 baskets. 2 more baskets than boxes</p> | <p>Other responses might be given. The ones shown are illustrative only.</p> <p>6 plants in all Subtract 1 plant. 5 more plants than boxes</p> |
| <p>5 boxes in all Subtract 2 boxes. 3 more boxes than books</p> | <p>6 plants in all Subtract 3 plants. 3 more plants than baskets</p> | <p>3 rabbits in all Subtract 2 rabbits. 1 more rabbit than birds</p> |
| <p>7 ducks in all Subtract 6 ducks. 1 more duck than rabbits</p> | <p>6 boxes in all Subtract 4 boxes. 2 more boxes than plants</p> | <p>7 boxes in all Subtract 2 boxes. 5 more boxes than plants</p> |

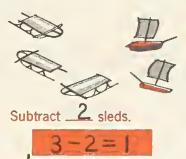
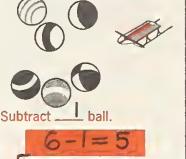
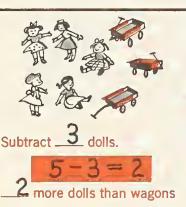
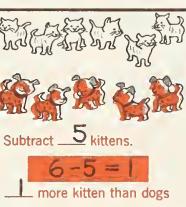
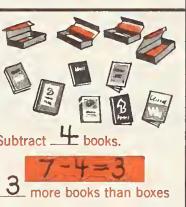
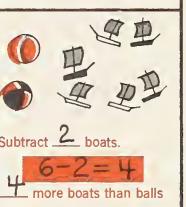
57

Direct attention to the first picture. Tell the children they are to find how many more flowers there are than boxes. Tell them to first match the box to a flower and draw a ring around the flower. Then they should take away as many flowers as there are boxes. Have them take away one flower by crossing it out. Have them add the first line and insert the correct numeral.

Tell the children to find how many flowers are left and write the numeral on the second line.

Have the children follow the same procedure for each picture on the page.

| | | | |
|---|--|---|--|
| <p>Subtract 1 flower. 5 more flowers than boxes</p> | <p>Subtract 2 baskets. 4 more baskets than boxes</p> | <p>Subtract 5 rabbits. 1 more rabbit than baskets</p> | <p>Subtract 1 plant. 4 more plants than flowers</p> |
| <p>Subtract 4 bears. 3 more bears than rabbits</p> | <p>Subtract 1 wagon. 2 more wagons than boxes</p> | <p>Subtract 2 cars. 3 more cars than baskets</p> | <p>Other responses might be given. The ones shown are illustrative only.</p> <p>Subtract 6 boxes. 1 more box than plants</p> |
| <p>Subtract 4 boxes. 2 more boxes than plants</p> | <p>Subtract 4 plants. 1 more plant than baskets</p> | <p>Subtract 3 flowers. 4 more flowers than boxes</p> | <p>Subtract 3 wagons. 3 more wagons than baskets</p> |

| | | | |
|--|---|---|---|
|  |  |  |  |
| 1 Subtract 3 cars. 2 $6 - 3 = 3$ 3 3 more cars than sleds | 4 Subtract 4 wagons. $5 - 4 = 1$ 1 more wagon than sleds | Subtract 5 boats. $7 - 5 = 2$ 2 more boats than cars | Subtract 2 dogs. $5 - 2 = 3$ 3 more dogs than wagons |
|  |  |  |  |
| Subtract 2 sleds. $3 - 2 = 1$ 1 more sled than boats | Subtract 2 baskets. $5 - 2 = 3$ 3 more baskets than boxes | Subtract 1 ball. $6 - 1 = 5$ 5 more balls than sleds | Subtract 3 kittens. $7 - 3 = 4$ 4 more kittens than boxes |
|  |  |  |  |
| Subtract 3 dolls. $5 - 3 = 2$ 2 more dolls than wagons | Subtract 5 kittens. $6 - 5 = 1$ 1 more kitten than dogs | Subtract 4 books. $7 - 4 = 3$ 3 more books than boxes | Subtract 2 boats. $6 - 2 = 4$ 4 more boats than balls |

59-63 HOW MANY MORE ARE NEEDED?

Objectives

Frequently, in problems, the question to be answered is: "How many more are needed?" For example: Jack has 4 cents. He wants to buy a toy car that costs 10 cents. How much more money does he need? Analysis of problems of this type shows that, first, there is a quantitative need to be met. (In this problem there is a need for 10 cents.) Second, some of the money required to meet the need is at hand. (Jack has 4 cents.) Third, the solution requires that more of whatever is needed be brought in and combined with what is at hand to make up the required amount. (Jack needs to add enough cents to his 4 cents to make 10 cents.) In such problem situations the child often recognizes the action as combining, or additive; thus when

he is told to find his answer by subtraction, he is confused.

Logically, the action involved in solving this problem is additive. More money is going to be put with the money that is already there. The difficulty arises because the number to be brought in is unknown, and the answer is obtained by subtraction. The situation is additive; the process required to solve the problem is subtraction.

In teaching children how to solve a problem of this type, it has been customary to tell them to "subtract the smaller number from the larger." Through constant drill, some children learn to solve problems of this type, but little has been done to help them understand why subtraction is used to solve an additive problem.

1 Direct attention to the first picture. Tell the children they are to find how many more cars there are than sleds. Tell them that they should take away as many cars as there are sleds. Have them read the first line and insert the correct numeral.

2 Explain to the children that they should write in the green strip the numerals and signs that tell how to find how many more cars than sleds are in the picture. See that they all write "6-3=3."

3 Tell the children to write the correct numeral on the bottom line.

4 Have the children follow the same procedure for each picture on the page.

The key to helping them to this understanding is the recognition that the needed additional quantity actually is brought in by additive action and put with the quantity already there. Simple problems of this kind can be solved with the objects themselves. Additional objects can be brought in, one by one, until the required total is at hand. The child then can see that the quantitative need stated in the problem has been met, and can determine the numeroseness of the group that has been "brought in."

In this section of the Teaching Guide the child is taught how to solve such problems with symbols and to understand why he subtracts. He is shown, by the procedure of separating the original objects from the total group, why he can subtract to find the answer. He learns also that

e can imagine the total needed quantity, including those at hand, and in think of the original quantity as being separated from the total. Then e will understand why he subtracts when he solves "how many more are needed" problems.

Preliminary Teaching

Before the children use Worksheets 9-63, they should learn that a problem of the "how many more are needed" type can be solved by subtracting from the total group the number at hand. The answer tells them the number needed. With this understanding, they can proceed to solve such problems without actually manipulating objects.

For the following activities, provide variety of sets of two kinds of objects that can reasonably be used together. (For example, you could use dolls, and chairs, hats, beds, or dresses for the dolls; egg boxes cut so that there are 3, 5, 6, or 7 egg containers in a unit together with dolls or other objects to put in them; booky boxes with compartments for 5, 6, or 7 objects and various toys, such as little cars or animals, to put in them; little paper houses and trees,ars, or dolls to put with them, etc.) You will also need a few larger boxes that will hold several of any of the above objects. Each child will need two sets of markers with at least 7 markers in each set.

In each activity suggested here, four steps are outlined. First, you show the children how many objects there should be in all and how many are at hand. For example, you might put dolls on a table and then put a doll at in front of each of 2 dolls. The children should see that more hats are needed if each doll is to have a hat. In the second step, the children suggest that more doll hats be brought in and put with the hats

already there. More doll hats are brought in, one by one, and put with the original 2 hats, until the required number (5) is reached. In the third step, the children observe that the quantitative need stated in the problem has been met. In the fourth step, you show them how the problem can be solved by the subtraction process: If the group originally present is thought of as separated or set aside from the total group, the remainder is the number "brought in."

It can hardly be overemphasized that this situation is basically additive. However, it can be solved by subtraction. This naturally is confusing to children. When the numbers are small, the difficulty is not apparent to adults, who simply "know" the answer. But keep in mind that all such problems are fundamentally the same, whether the need is enough more dolls to complete a group of 7 dolls when 4 dolls are on hand, or whether a certain sum of money is needed to make up a total of \$2357 when the amount on hand is \$865. The following activities will lay a foundation for gradual development of a real understanding of this type of problem.

Place 7 dolls on a table in the front of the room. Put a doll hat in front of each of 3 dolls. Ask such questions as: "How many dolls are there? How many hats would we need for each doll to have one? Are there enough hats there now? What should we do?" Lead the children to say that more hats are needed. Say: "Put a marker on your desk for each doll. How many markers did you put down? [7] Now put down a different kind of marker for each hat we already have. How many markers did you put down? [3]" Show the children a box. Say: "What do you suppose is in this box? [More hats] Let's give them to the dolls who have no hats. [Put a hat in front of each

of the 4 hatless dolls.] Are there enough now? Show with your markers how many more hats we gave to the dolls. [The children should put 4 more of the second group of markers in front of the first group.] How many markers did you use? Is that enough? How many hats did we need in all? How many hats did we have at first? How many more hats did we need?" Proceed as follows: "Now I am going to show you why we can subtract to find out how many more hats were needed. We needed 7 hats in all, because we had 7 dolls. But we had only 3 hats. What did we do? [We put more hats with them and now there are enough.] Now watch: If I take away the 3 hats we had at first [remove them], 4 hats are left. These are the hats that were needed."

Repeat this activity with various sets of objects.

Now repeat the activity suggested above, but this time do not have the children set up a group of markers for the total group. Have them show markers only for the objects that were on hand to start with and for those that were added. Say: "How many balls will this box hold? [5] How many balls are on the table? [2] Put a marker on your desk for each ball that is on the table. Now put more markers down until you have enough to fill the box. (Do not demonstrate this part of the action yourself.) How many more markers did you use? Can you say that 3 more balls are needed? What do you have on your desks now? [A marker for each of the five balls, including the 2 that were on hand.] What should you do with your markers to show how many more balls are needed for the box on the table? [Take 2 away.] Why do you take away 2 markers?" The children's responses should indicate that they understand that they subtract the 2 balls that were already

on the table from the 5 that the box holds. Conclude by having them make such statements as: "5 balls minus 2 balls are 3 balls" and "5 minus 2 equals 3."

Use similar procedures with other objects.

[Worksheets 59-63 can be used at this point.]

59 Comments

On this page the children learn to read and complete sentences that express the situation and the actions involved in problems of the "how many more are needed" type.

In the activities suggested in the "Preliminary Teaching" section for these pages, the children actually performed the actions that showed them why they can subtract to solve "how many more are needed" problems. On Worksheets 59-61 they learn to relate these actions to sentences that interpret the actions, and, finally, they simply observe the problem situation, imagine the action needed to solve it, and express the final step in the action as the appropriate subtraction basic fact.

To introduce Worksheet 59, provide some boxes or containers like those pictured on the page and some objects to put in the containers. First show the children a container (for example, for 6 balls) and 2 balls to put in it. Write on the board, "This is a box for ____ balls" and under it, "They are ____ balls." Have a child read the first sentence aloud, and ask the class what should be written on the blank line. Let a child write the numeral 6 on the first line. Ask another child to read the second sentence, and ask what should be written on the line. Let one of the children write the numeral 2 on this line. Ask how many balls will fill the box. [6, because there are 6 compartments in

the box.] Write "6 balls — ____ balls = ____ balls" on the board. Remove the box from the table and put 6 balls there. Ask how many balls are on the table and why there are that many. [Because that is the total number needed] Ask what should be done to find how many more balls were needed. [Take away the 2 balls that were there to start with.] Let a child remove 2 balls. Have another child read the last sentence on the board. Let other children first tell what should be written on the answer lines and then write the appropriate numerals where they belong. Finally, write on the board, "____ more balls are needed." Let the children discuss this sentence and supply the answer. Have someone write it on the board.

Ask the children to open their books to page 59. Get them to observe that heavy black lines divide the pictures into pairs. Discuss one or two of the pairs of pictures and the sentences within the pictures. Then use the keyed notes on page 75 of this Teaching Guide. Let the children discuss their responses.

60 Comments

On this page the child continues the work begun on page 59.

This page is like page 59 in purpose and technique. The "Comments" for that page apply to this page also.

Introduce Worksheet 60 by getting the children to tell what they think they are to do. If necessary, use activities like those suggested for Worksheet 59 to show the children what is required. Let the children compare and discuss their responses.

61 Comments

On this page the child imagines the action that precedes the subtraction operation in "how many more are

needed" problems. They write the subtraction basic facts for the problems.

To introduce Worksheet 61, help the children see that each picture contains all the elements of the type of problem they have been working, but that now they must mentally go through the steps up to the point where they complete a statement ("7¢ - 3¢ = 4¢," for example).

In the colored answer space, the children are to write the subtraction basic fact that shows how to find how many more pennies are needed to buy the article pictured. Let them tell what they should write on the last answer line in each picture [the numeral that stands for the number of pennies needed].

Directions for Exercises A to Q are given in the keyed notes on page 76 of this Teaching Guide. Let the children discuss their answers.

62-63 Comments

On page 62 the children match basic facts in equation form with pictures that show appropriate actions. They supply answers for these basic facts. This work, and the exercises on page 63, constitute review on the addition and subtraction basic facts for the groups of 3, 5, 6, and 7.

The addition and subtraction basic facts are presented in several ways all of which should be familiar to the children by now. Exercises A to Q, in the right-hand column on page 63 give the children experience in translating a sentence into arithmetic symbolism.

No preliminary work need be done for these exercises. However, you should make sure the children understand what they are to do with each set of exercises. Any reteaching that is necessary should be done before the next unit is presented.

59

Point out the heavy black lines that divide the pictures into pairs. Have the children read the first sentence in the first picture and use the picture to find the answer. They should do the same for the second sentence. Tell the children to write the answers on the green lines.

Ask how many balls are shown in the second picture and why there are not many. Direct attention to the first sentence. Ask how many balls could be subtracted from the 6 balls [6]. Tell the children to cross off that many balls in the picture and then write the appropriate numeral on the first answer line. Ask why 4 should be written on the next answer line. Tell them to write the correct numeral in the second sentence.

Have the children follow the same procedure for each pair of pictures on the page.

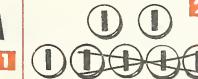
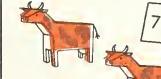
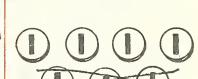
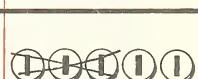
| | | | |
|--|---|---|---|
|  1 This is a box for <u>6</u> balls. There are <u>2</u> balls. |  2 6 balls - <u>2</u> balls = <u>4</u> balls <u>4</u> more balls are needed. |  3 This is a boat for <u>7</u> dolls. There are <u>5</u> dolls. |  7 dolls - <u>5</u> dolls = <u>2</u> dolls <u>2</u> more dolls are needed. |
|  1 Other responses might be given. The ones shown are illustrative only. This is a box for <u>3</u> toy cars. There are <u>2</u> toy cars. |  2 3 cars - <u>2</u> cars = <u>1</u> car <u>1</u> more car is needed. |  3 This is a box for <u>5</u> dolls. There is <u>1</u> doll. |  5 dolls - <u>1</u> doll = <u>4</u> dolls <u>4</u> more dolls are needed. |
|  1 This is a box for <u>7</u> toy cows. There are <u>3</u> toy cows. |  2 7 cows - <u>3</u> cows = <u>4</u> cows <u>4</u> more cows are needed. |  3 This is a box for <u>6</u> toy dogs. There are <u>4</u> toy dogs. |  <u>6</u> dogs - <u>4</u> dogs = <u>2</u> dogs <u>2</u> more dogs are needed. |

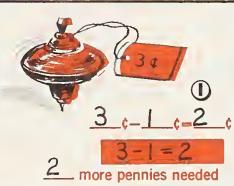
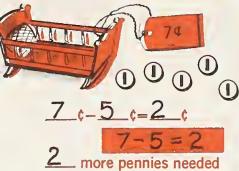
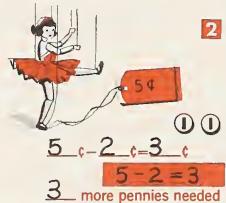
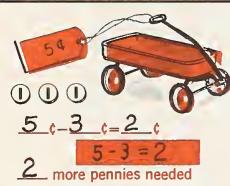
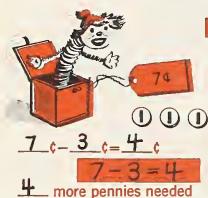
60

Have the children read the first sentence in the first picture and use the picture to find the answer. They should do the same for the second sentence. Tell the children to write the answers on the green lines.

Ask how many pennies are shown in the second picture and why there are not many. Direct attention to the first sentence. Ask how many pennies could be subtracted from the 7 pennies [4]. Tell the children to cross off that many pennies in the picture and then write the appropriate numeral on the first answer line. Ask why 3 should be written on the next answer line. Tell the children to write the correct numeral in the second sentence.

Have the children follow the same procedure for each pair of pictures on the page. They should work independently, if possible.

| | | | |
|--|---|--|---|
|  1 7¢ will buy the boat. There are <u>4</u> ¢. |  2 $7\text{¢} - \underline{4\text{¢}} = 3\text{¢}$ <u>3</u> more pennies needed |  3 5¢ will buy the pigs. There are <u>2</u> ¢. |  $5\text{¢} - \underline{2\text{¢}} = 3\text{¢}$ <u>3</u> more pennies needed |
|  1 <u>6</u> ¢ will buy the bears. There are <u>2</u> ¢. |  2 $6\text{¢} - \underline{2\text{¢}} = 4\text{¢}$ <u>4</u> more pennies needed |  3 7¢ will buy the cows. There are <u>3</u> ¢. |  $7\text{¢} - \underline{3\text{¢}} = 4\text{¢}$ <u>4</u> more pennies needed |
|  1 <u>5</u> ¢ will buy the dogs. There is <u>1</u> ¢. |  Other responses might be given. The ones shown are illustrative only. 2 $5\text{¢} - \underline{1\text{¢}} = 4\text{¢}$ <u>4</u> more pennies needed |  3 <u>6</u> ¢ will buy the rabbits. There are <u>3</u> ¢. |  $6\text{¢} - \underline{3\text{¢}} = 3\text{¢}$ <u>3</u> more pennies needed |

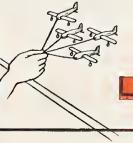
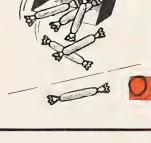
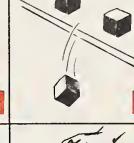
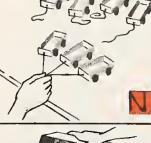
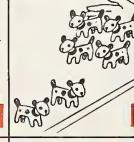
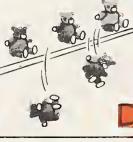
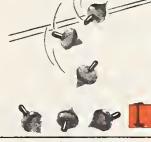
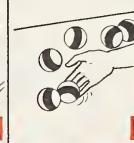


| | | |
|----------|-------------------|-------------|
| A | $5 = 2 + \square$ | $5 - 2 = 3$ |
| B | $7 = 4 + \square$ | $7 - 4 = 3$ |
| C | $3 = 1 + \square$ | $3 - 1 = 2$ |
| D | $6 = 3 + \square$ | $6 - 3 = 3$ |
| E | $5 = 4 + \square$ | $5 - 4 = 1$ |
| F | $7 = 2 + \square$ | $7 - 2 = 5$ |
| G | $6 = 1 + \square$ | $6 - 1 = 5$ |
| H | $6 = 4 + \square$ | $6 - 4 = 2$ |
| I | $7 = 3 + \square$ | $7 - 3 = 4$ |
| J | $5 = 5 + \square$ | $7 - 5 = 2$ |
| K | $6 = 2 + \square$ | $6 - 2 = 4$ |
| L | $3 = 2 + \square$ | $3 - 2 = 1$ |
| M | $5 = 3 + \square$ | $5 - 3 = 2$ |
| N | $6 = 5 + \square$ | $6 - 5 = 1$ |
| O | $7 = 6 + \square$ | $7 - 6 = 1$ |
| P | $5 = 1 + \square$ | $5 - 1 = 4$ |
| Q | $7 = 1 + \square$ | $7 - 1 = 6$ |

1 Follow the procedure suggested under "Comments" for introducing the page. Then work through the first picture with the children. Be sure they understand that the first sentence should be completed to read "7¢ - 3¢ = 4¢," that they should write "4 more pennies needed" in the green answer space and that the last line should be completed to read "4 more pennies needed."

2 Have the children follow the same procedure for each picture on the page.

3 In Exercise A to Q, the children are to write, for each exercise, the subtraction basic fact they would use to find the numeral that belongs where the screen is. For example, Exercise A the children should write "5 - 2 = 3" on the answer line.



| | | |
|----------|-------------|----------|
| A | $3 + 2 = 5$ | 1 |
| B | $2 + 4 = 6$ | 2 |
| C | $4 + 3 = 7$ | |
| D | $5 - 2 = 3$ | |
| E | $1 + 2 = 3$ | |
| F | $4 + 2 = 6$ | |
| G | $7 - 6 = 1$ | |
| H | $6 - 2 = 4$ | |
| I | $3 + 3 = 6$ | |
| J | $2 + 5 = 7$ | |
| K | $7 - 5 = 2$ | |
| L | $6 - 4 = 2$ | |
| M | $3 - 1 = 2$ | |
| N | $7 - 3 = 4$ | |
| O | $1 + 5 = 6$ | |
| P | $2 - 1 = 1$ | |
| Q | $6 + 1 = 7$ | |

1 Direct attention to the exercises with green letters (A to Q). Tell the children to read Exercise A and find the picture that goes with it. They can write the letter A in the green answer space in that picture. Then they write the answer for Exercise A on the answer line in the exercise.

2 The same procedure should be followed for the other exercises and pictures. Tell the children that if they find an exercise for which there is no picture, they are just to write the answer for the exercise on the answer line.

Direct attention to the first column of exercises. Tell the children to read each exercise and write the correct numeral on the answer line.

Have the children follow the same procedure for the second column of exercises.

Direct attention to the last column of exercises. Tell the children to write, in each answer line, the addition or subtraction basic fact they must use to find the answer to the exercise. For example, for Exercise A they should write "3+4=7."

| 1 | 2 | 3 |
|---|-----------------|-----------------------------------|
| A 1 doll plus 2 dolls is <u>3</u> dolls. | A 3+4= <u>7</u> | A Add 3 and 4. <u>3+4=7</u> |
| B 7 boxes minus 3 boxes are <u>4</u> boxes. | B 6-2= <u>4</u> | B Subtract 2 from 5. <u>5-2=3</u> |
| C 3 balls plus 2 balls are <u>5</u> balls. | C 7-5= <u>2</u> | C Add 4 and 1. <u>4+1=5</u> |
| D 5 books plus 2 books are <u>7</u> books. | D 1+5= <u>6</u> | D Add 3 and 3. <u>3+3=6</u> |
| E 3 bags minus 2 bags are <u>1</u> bag. | E 2-1= <u>1</u> | E Subtract 1 from 5. <u>5-1=4</u> |
| F 7 boys minus 5 boys are <u>2</u> boys. | F 5-4= <u>1</u> | F Add 4 and 2. <u>4+2=6</u> |
| G 3 tables minus 1 table are <u>2</u> tables. | G 4+2= <u>6</u> | G Subtract 4 from 6. <u>6-4=2</u> |
| H 1 bird plus 2 birds is <u>3</u> birds. | H 6+1= <u>7</u> | H Add 5 and 1. <u>5+1=6</u> |
| I 4 men plus 3 men are <u>7</u> men. | I 7-4= <u>3</u> | I Subtract 4 from 7. <u>7-4=3</u> |
| J 7 dogs minus 2 dogs are <u>5</u> dogs. | J 6-5= <u>1</u> | J Add 1 and 1. <u>1+1=2</u> |
| K 6 sleds plus 1 sled are <u>7</u> sleds. | K 2+1= <u>3</u> | K Add 2 and 5. <u>2+5=7</u> |
| L 5 girls minus 3 girls are <u>2</u> girls. | L 5-4= <u>1</u> | L Subtract 6 from 7. <u>7-6=1</u> |
| M 6 cars minus 1 car are <u>5</u> cars. | M 7-1= <u>6</u> | M Add 2 and 4. <u>2+4=6</u> |
| N 2 cows plus 5 cows are <u>7</u> cows. | N 3+3= <u>6</u> | N Subtract 1 from 3. <u>3-1=2</u> |
| O 1 duck plus 6 ducks is <u>7</u> ducks. | O 1+4= <u>5</u> | O Add 2 and 3. <u>2+3=5</u> |
| P 1 boat plus 5 boats is <u>6</u> boats. | P 6-3= <u>3</u> | P Subtract 1 from 2. <u>2-1=1</u> |
| Q 7 plants minus 1 plant are <u>6</u> plants. | Q 2+4= <u>6</u> | Q Subtract 3 from 5. <u>5-3=2</u> |

64-74 THE GROUP OF 8 AND THE GROUP OF 4

Objectives

The characteristics of the group of 8 are the same as those of the group of 4. The group of 8 can, therefore, be taught in the same way. However, two types of problems that were not studied with the group of 6—comparison by subtraction and "how many more are needed"—were introduced in the two sections just completed and are included in the exercises for the group of 8.

Only two new multiplication facts come from the group of 8: combining 4 twos and combining 2 fours. There are also two new division facts: separating 8 into 4 twos and into 2 fours. The "sharing" type of division situation (sometimes called partition), in which the number of equal groups is known and the number in each group

is to be found, is also given some attention. The basic facts for the group of 4, with which many children are already familiar, are introduced.

Preliminary Teaching

Before the children use Worksheets 64-74, they should be able to combine the subgroups that make a group of 8; to separate a group of 8 into its subgroups; to solve by subtraction problems that involve comparison and the "how many more are needed" idea; to bring together equal groups to make a group of 8; and to separate a group of 8 into equal groups. They should also learn the addition and subtraction facts for the group of 4.

The activities used to teach the basic facts for the group of 6 and the other groups the children have been

taught up to this point, may be used to teach the basic facts for the group of 8. Give each child 8 markers, and adapt the activities suggested in "Preliminary Teaching" for the addition basic facts for the group of 6 on pages 47-48 of this Teaching Guide.

[Worksheet 64 can be used at this point.]

Adapt the activities suggested for teaching the subtraction basic facts for the group of 6 (see page 49 of this Teaching Guide) to the subtraction basic facts for the group of 8. Be sure to give the children many opportunities to discriminate between subtracting to find a remainder and subtracting to find how many more are in one group than in another. Each child will need 16 markers, 8 of one kind and 8 of another kind.

[Worksheets 65 and 66 can be used at this point.]

Review the "how many more are needed" type of problem with the children. Use facts from the groups of 3, 5, 6, 7, and 8. The type of activities suggested in the "Preliminary Teaching" section for pages 59-63 (page 73 of this Teaching Guide) may be adapted for use here.

[Worksheets 67 and 68 can be used at this point.]

To teach the children to combine 4 twos and 2 fours to make 8, use the type of activity suggested in "Preliminary Teaching" for Worksheet 44 (combining equal groups to make a group of 6) on pages 49-50 of this Teaching Guide.

[Worksheet 69 can be used at this point.]

Use activities similar to those suggested in "Preliminary Teaching" for Worksheet 45 (separating a group of 6 into equal groups, on page 50 of this Teaching Guide) to show the separation of a group of 8 into two groups of 4 and into four groups of 2 (finding how many equal groups when the size of the group is known).

[Worksheet 70 can be used at this point.]

Use activities similar to those used for page 70 to teach the children to separate a group of 8 into a given number of equal groups. It is best to start teaching this type of division by having 2 children or 4 children (the number of children representing the number of groups) separate a group of 8 by each taking one object in turn, until the 8 objects are all used and each child has the same number of objects. They then should determine how many are in each group. Be sure they finish each activity by saying "eight equals two groups of four" or "eight equals four groups of two." Next, have them do the same type of division, using markers.

[Worksheet 71 can be used at this point.]

Worksheets 72 and 73 provide practice on the addition and subtraction basic facts for the group of 8 and some review on the groups of 3, 5, 6, and 7. No preliminary teaching will be needed for these pages.

[Worksheets 72 and 73 can be used at this point.]

Many of the children are probably already familiar with the group of 4. The basic facts for this group are presented on Worksheet 74. Have the children work with markers in the ways that have been used to teach the basic facts for the other groups.

[Worksheet 74 can be used at this point.]

64 Comments

On this page the child learns the addition basic facts for the group of 8.

The activities suggested for this page in "Preliminary Teaching" should be an adequate introduction. When the children have had enough practice on the addition basic facts for the group of 8, give them directions for the work on Worksheet 64. Use the keyed notes on page 80 of this Teaching Guide.

A transparent overlay may be used to check this page.

65 Comments

On this page the child learns the subtraction basic facts for the group of 8 and solves problems involving comparison by subtraction. Basic facts for the group of 8 are used.

The exercises above the heavy black line on this page show a group of 8 separating into two groups. The children are to imagine that the action is completed and write on the answer line the number of birds that remain.

The exercises below the heavy black line show comparison problems

like those on page 57. The children should be able to do all the work on this page as soon as they are reasonably familiar with the subtraction basic facts for the group of 8.

66 Comments

On this page the child learns to use symbols to express the addition and subtraction basic facts for the group of 8. He associates the symbolism with action shown in pictures.

The pictures provide practice on the addition and subtraction basic facts and comparison by subtraction problems for the group of 8. The two columns of exercises on the right side of the page include practice on the addition and subtraction basic facts for the groups of 2, 3, 5, 6, 7, and 8.

To introduce the page, demonstrate one or two addition facts and one or two subtraction facts for the group of 8 with books or large markers. Have all the children write each fact in horizontal form on a sheet of paper. Let several children write them on the chalkboard. Then have the children open their books to Worksheet 66. Work through the three top pictures with them.

A transparent overlay may be used to check this page. Be sure the responses are placed so that they do not obscure the children's answers.

67 Comments

On this page the child practices the "how many more are needed" type of problem. They use basic facts from the group of 8.

Since this page is like page 59, the "Comments" for Worksheet 59 (see page 74 of this Teaching Guide) can be adapted for Worksheet 67.

When the children have finished their work, let them compare and discuss their responses.

68

Comments

In this page the child continues to work with "how many more are needed" situations.

This page is like page 61, and the "Comments" for Worksheet 61 (see page 74 of this Teaching Guide) can be adapted for Worksheet 68.

Let the children compare and discuss their responses.

69

Comments

In this page the child gets further experience with the concept of multiplication that was introduced on page 44 of Our Number Workshop 2. He learns that 4 twos are 8 and 2 fours are 8.

Because the idea of multiplication is still new to the children, you should spend considerable time in discussing the action in each of the pictures. When the children have written the appropriate numerals on the green lines, discuss the answers with them.

Exercises A to Q on the right side of the page provide a short general review.

70

Comments

In this page the child learns that a group of 8 can be separated into 2 groups of 4 and into 4 groups of 2.

The concept of division was introduced on page 45 of Our Number Workshop 2 with basic facts for the group of 6. On Worksheet 70 the children practice the basic facts for the group of 6 and learn the basic facts for the group of 8.

Because the idea of division is still new to the children, spend considerable time in discussing the action in each of the pictures on the page. When the children have written the appropriate numerals on the green lines, discuss the answers with them.

Exercises A to Q provide a short general review.

71

Comments

In this page the child learns to separate a group of 8 into a specified number of equal groups.

This lesson introduces the idea of separating a group into a specified number of smaller groups that are the same in number. This type of division is called *partition*, and it is often referred to as "sharing." The work is confined to distributing a group of 6 or 8 objects into a given number of groups.

To introduce this page, draw on the chalkboard three pictures, each of which shows a group of 8 or a group of 6. Draw large dots and write expressions like those on Worksheet 71. Let the children draw the lines and write the answers. Then have them open their books to Worksheet 71. Use the keyed notes on page 83 of this Teaching Guide.

Let the children compare and discuss their responses.

72

Comments

In this page the children distinguish between additive action and subtractive action. They also symbolize the action shown in pictures and the result of the action by writing the basic facts indicated in the pictures.

To introduce this page, write the words *plus* and *minus* on the chalkboard. With objects large enough to be seen easily by the children, demonstrate a subtraction or an addition basic fact for the group of 8. Have the children tell you whether the action suggests *plus* or *minus*. Let a child write on the board the basic fact you demonstrated, while the other children write it on a piece of paper and compare their fact with the work

on the board. Repeat this activity several times with other basic facts.

A transparent overlay may be used to check this page.

73

Comments

In this page the children practice the addition and subtraction basic facts for the groups of 3, 5, 6, 7, and 8.

These basic facts should be familiar to the children. The exercises in the third column give them another opportunity to write the facts in symbolic form.

No preliminary teaching is needed for this page. However, you should make sure the children know what to do with each set of exercises.

A transparent overlay can be used to check this page.

74

Comments

In this page the children study the addition and subtraction basic facts for the group of 4. They learn that two groups of 2 can be combined to make a group of 4 and that a group of 4 can be separated into two groups of 2.

Since most children are already familiar with the basic facts for the group of 4, only one page is provided for this group.

No introduction other than instructions for the work should be needed for this page.

Exercises A to Q on the right side of the page include facts from all the groups the children have worked with up to this time.

When the children have completed the work on this page, let them compare and discuss their responses.



1 Direct attention to the key picture with the green background. Get the children to observe that it shows a group of 8 birds.

2 Tell the children to look at the next picture and decide whether or not it will show a group of 8 when the action has been completed. If they think it will show a group of 8, they are to make an X in the green response space. If they think it will not, they are to make a scribble mark (Z).

3 Tell the children to follow the same procedure for each picture on the page.

| | | | |
|---|---|---|---|
| 1 4 birds left | 2 7 birds left | 3 2 birds left | 4 5 birds left |
| bird left | 5 6 birds left | 6 3 birds left | 7 2 birds left |
| 1 Subtract 3 dogs. 5 more dogs than rabbits | 2 Subtract 2 ducks. 6 more ducks than birds | 3 Subtract 7 rabbits. 1 more rabbit than dogs | 4 might be given. The illustrative scale Subtract 4 ducks. 4 more ducks than birds |
| 5 Subtract 5 birds. 3 more birds than rabbits | 6 Subtract 6 dogs. 2 more dogs than ducks | 7 Other responses ones shown are Subtract 7 rabbits. 1 more rabbit than dogs | 8 Subtract 8 ducks. 8 more ducks than birds |

1 Direct attention to the exercise above the heavy black line. Tell the children to look at each picture, decide how many birds will be left when the group that is flying away is gone, and write the correct number on the green line.

2 Direct attention to the exercise below the heavy black line. Tell the children to cross off in the large group in each picture as many animals or birds as are in the small group and write the numeral on the first answer line. Tell them to decide how many more animals are in the larger group than in the small group. They then write that number on the second answer line. When the children have completed the work on the page, let them compare and discuss their responses.

Tell the children to look at the first picture, and read the expression below the green answer space. They are to write in the answer space the basic fact they would use to find how many birds there are in all. [The children should write $6+2=8$.] Then tell them to write the correct numeral in the green line in the expression below the answer space.

The same procedure should be followed for each picture on the page.

Direct attention to the two columns of exercises. Tell the children they are to read each exercise and write the answer on the green line.

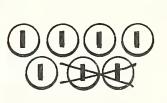
| | | |
|--|---|--|
|  1 $6 + 2 = 8$ 8 birds in all |  2 $8 - 3 = 5$ 5 more chickens than rabbits |  3 $8 - 4 = 4$ 4 bears will be left. |
|  4 $3 + 5 = 8$ 8 kittens in all |  5 $8 - 6 = 2$ 2 more rabbits than birds |  6 $7 + 1 = 8$ 8 pigs in all |
|  7 $8 - 5 = 3$ 3 squirrels will be left. |  8 $8 - 2 = 6$ 6 more ducks than birds |  9 $5 + 3 = 8$ 8 dogs in all |
|  10 $4 + 4 = 8$ 8 turtles in all |  11 $8 - 1 = 7$ 7 more birds than rabbits |  12 $8 - 7 = 1$ 1 cow will be left. |

3
 A $1 + 6 = 7$
 B $8 - 2 = 6$
 C $8 - 6 = 2$
 D $4 + 4 = 8$
 E $5 - 3 = 2$
 F $6 + 2 = 8$
 G $5 - 4 = 1$
 H $8 - 7 = 1$
 I $4 + 2 = 6$
 J $3 + 3 = 6$
 K $6 - 4 = 2$
 L $8 - 3 = 5$
 M $5 + 3 = 8$
 N $6 - 2 = 4$
 O $7 + 1 = 8$
 P $3 + 4 = 7$
 Q $8 - 1 = 7$
 R $1 + 1 = 2$
 S $8 - 2 = 6$
 T $7 - 2 = 5$
 U $2 + 1 = 3$
 V $3 + 5 = 8$
 W $7 - 4 = 3$
 X $3 + 2 = 5$
 Y $8 - 5 = 3$
 Z $7 - 3 = 4$
 AA $1 + 4 = 5$
 BB $7 - 6 = 1$
 CC $2 + 4 = 6$
 DD $8 - 4 = 4$
 EE $4 + 3 = 7$
 FF $6 - 5 = 1$
 GG $8 - 6 = 2$
 HH $2 + 6 = 8$
 II $2 + 5 = 7$

Point out the heavy black lines that divide the pictures on the page into pairs. Have the children read the first sentence in the first picture and use the picture to find the numeral they are to write on the answer line. Have them do the same with the second sentence.

Ask how many dogs are shown in the second picture, and why there are that many. Direct attention to the first sentence in this picture. Ask how many dogs should be taken away from the 8 dogs [4]. Tell the children to cross off that many dogs in the picture and write the appropriate numeral on each answer line in the first sentence. Then tell them to write the correct numeral on the answer line in the second sentence.

Have the children follow the same procedure for each pair of pictures on the page.

| | | | |
|--|---|---|--|
|  1 This box is for 8 dogs. There are 4 dogs. |  2 8 dogs - 4 dogs = 4 dogs 4 more dogs are needed. |  3 7 pennies will buy the doll. There are 2 pennies. |  4 7 pennies - 2 pennies = 5 pennies 5 more pennies are needed. |
|  5 This box is for 8 balls. There is 1 ball. |  6 8 balls - 1 ball = 7 balls 7 more balls are needed. |  7 8 pennies will buy the car. There are 6 pennies. |  8 8 pennies - 6 pennies = 2 pennies 2 more pennies are needed. |
|  9 5 pennies will buy the book. There are 3 pennies. |  10 Other responses might be given. The ones shown are illustrative only. 5 pennies - 3 pennies = 2 pennies 2 more pennies are needed. |  11 This box is for 6 cows. There are 5 cows. |  12 6 cows - 5 cows = 1 cow 1 more cow is needed. |

1  8¢

① ① ①

$$\underline{8\text{¢}} - \underline{3\text{¢}} = \underline{5\text{¢}}$$

5 more cents are needed.

2  5¢

① ① ① ①

$$\underline{5\text{¢}} - \underline{4\text{¢}} = \underline{1\text{¢}}$$

1 more cent is needed.

- 3** 8-5=3
- A $8=5+\underline{\quad}$ 3-1=2
- B $3=1+\underline{\quad}$ 8-3=5
- C $8=3+\underline{\quad}$ 6-5=1
- D $6=5+\underline{\quad}$ 2-1=1
- E $2=1+\underline{\quad}$ 8-7=1
- F $8=7+\underline{\quad}$ 7-6=1
- G $7=6+\underline{\quad}$ 5-3=2
- H $5=3+\underline{\quad}$ 8-1=7
- I $8=1+\underline{\quad}$ 6-3=3
- J $6=3+\underline{\quad}$ 6-2=4
- K $6=2+\underline{\quad}$ 8-4=4
- L $8=4+\underline{\quad}$ 5-2=3
- M $5=2+\underline{\quad}$ 6-4=2
- N $6=4+\underline{\quad}$ 8-6=2
- O $8=6+\underline{\quad}$ 8-2=6
- P $8=2+\underline{\quad}$ 7-4=3
- Q $7=4+\underline{\quad}$

1  6¢

①

$$\underline{6\text{¢}} - \underline{1\text{¢}} = \underline{5\text{¢}}$$

5 more cents are needed.

2  7¢

① ①

$$\underline{7\text{¢}} - \underline{2\text{¢}} = \underline{5\text{¢}}$$

5 more cents are needed.



4 groups of frogs
2 frogs in each group
8 frogs in all
 $4 \text{ twos} = \underline{8}$



2 groups of dogs
3 dogs in each group
6 dogs in all
 $2 \text{ threes} = \underline{6}$



2 groups of ducks
4 ducks in each group
8 ducks in all
 $2 \text{ fours} = \underline{8}$

- 3** 3
- A $3 \text{ twos} = \underline{6}$
- B $4 \text{ quarts} = \underline{8} \text{ pints}$
- C $4+2 = \underline{6}$
- D $5-3 = \underline{2}$
- E $2 \text{ fours} = \underline{8}$
- F $2 \text{ nickels} = \underline{10} \text{ cents}$
- G $1 \text{ dime} = \underline{2} \text{ nickels}$
- H $2 \text{ threes} = \underline{6}$



3 groups of cows
2 cows in each group
6 cows in all
 $3 \text{ twos} = \underline{6}$



4 groups of mice
2 mice in each group
8 mice in all
 $4 \text{ twos} = \underline{8}$



2 groups of horses
3 horses in each group
6 horses in all
 $2 \text{ threes} = \underline{6}$

- I $5-4 = \underline{1}$
- J $3+3 = \underline{6}$
- K $7-4 = \underline{3}$
- L $4 \text{ twos} = \underline{8}$
- M $6 \text{ pints} = \underline{3} \text{ quarts}$
- N $2-1 = \underline{1}$
- O $7-6 = \underline{1}$
- P $2+4 = \underline{6}$
- Q $7-3 = \underline{4}$



4 groups of pigs
2 pigs in each group
8 pigs in all
 $4 \text{ twos} = \underline{8}$



3 groups of birds
2 birds in each group
6 birds in all
 $3 \text{ twos} = \underline{6}$



2 groups of bears
4 bears in each group
8 bears in all
 $2 \text{ fours} = \underline{8}$

1 Call attention to the first picture and work through the exercise with the children. Be sure they understand that the first sentence should be completed to read "8¢-3¢=5¢," that they should write "8-3=5" in the green answer strip, and that the last line should be completed to read "5 more cents are needed."

2 Have the children follow the same procedure for each picture on the page.

3 In Exercises A to Q at the right of the page, the children are to write the subtraction basic fact they would use to find the numeral that belongs where the screen is. For example, in Exercise A they should write "8-5=3."

1 Direct attention to the first picture. Ask how many groups of frogs are shown and how many frogs are in each group. Tell the children to read the expressions included with the picture and to use the picture to find the numerals that are to be written on the answer lines.

2 Have the children follow the same procedure for each picture on the page.

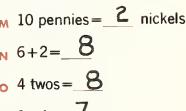
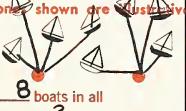
3 The children should read each exercise in the column on the right side of the page and write the answer on the green line.

70

Ask the children to read the first expression in the first picture and the picture to find the answer. Then let them read the second expression and encircle groups of 2. Now let them read the third expression and write the numeral that tells the number of groups of 2 frogs. Finally, let them write the correct numeral on the last answer line.

Have the children follow the same procedure for each of the pictures on page.

The children should read each expression in the column on the right side of the page and write the answer on the green line.

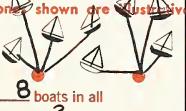
| | | | | | | | | |
|--|--|--|---|--|--|--|--|---|
|  8 frogs in all Put 2 frogs in each group. <u>4</u> groups of 2 frogs 8 = <u>4</u> twos |  6 bears in all Put 3 bears in each group. <u>2</u> groups of 3 bears 6 = <u>2</u> threes |  8 cows in all Put 4 cows in each group. <u>2</u> groups of 4 cows 8 = <u>2</u> fours | 3 A 6 = <u>3</u> twos B 8 = <u>2</u> fours C 6 - 4 = <u>2</u> D 2 threes = <u>6</u> E 4 quarts = <u>8</u> pints F 2 dimes = <u>4</u> nickels G 5 - 1 = <u>4</u> H 6 = <u>2</u> threes I 8 = <u>4</u> twos J 4 + 4 = <u>8</u> K 2 fours = <u>8</u> L 3 twos = <u>6</u> | | | | | |
| <i>Other responses might be given. The ones shown are illustrative only.</i> | |  8 dogs in all Put 4 dogs in each group. <u>2</u> groups of 4 dogs 8 = <u>2</u> fours |  6 kittens in all Put 2 kittens in each group. <u>3</u> groups of 2 kittens 6 = <u>3</u> twos |  8 mice in all Put 2 mice in each group. <u>4</u> groups of 2 mice 8 = <u>4</u> twos |  6 pigs in all Put 3 pigs in each group. <u>2</u> groups of 3 pigs 6 = <u>2</u> threes |  8 ducks in all Put 4 ducks in each group. <u>2</u> groups of 4 ducks 8 = <u>2</u> fours |  6 turtles in all Put 2 turtles in each group. <u>3</u> groups of 2 turtles 6 = <u>3</u> twos |  10 pennies = <u>2</u> nickels N 6 + 2 = <u>8</u> O 4 twos = <u>8</u> P 3 + 4 = <u>7</u> Q 5 - 3 = <u>2</u> |
|  8 dolls in all Make <u>4</u> equal groups. <u>2</u> dolls in each group 8 = 4 groups of <u>2</u> |  8 cars in all Make <u>4</u> equal groups. <u>2</u> cars in each group 8 = 2 groups of <u>4</u> |  6 balls in all Make <u>2</u> equal groups. <u>3</u> balls in each group 6 = 2 groups of <u>3</u> | 3 A 6 = 3 twos threes B 8 = <u>4</u> twos C 6 = <u>3</u> twos D 2 fours = <u>8</u> E 7 - 3 = <u>4</u> F 6 - 1 = <u>5</u> G 3 twos = <u>6</u> H 8 = 2 twos fours I 5 + 1 = <u>6</u> J 6 = 2 twos threes K 5 - 2 = <u>3</u> L 4 twos = <u>8</u> M 2 - 1 = <u>1</u> N 8 - 4 = <u>4</u> O 3 + 5 = <u>8</u> P 8 - 7 = <u>1</u> Q 8 = 4 twos dots | | | | | |
| <i>Other responses might be given. The ones shown are illustrative only.</i> | |  8 boats in all Make <u>2</u> equal groups. <u>4</u> boats in each group 8 = 2 groups of <u>4</u> |  6 books in all Make <u>3</u> equal groups. <u>2</u> books in each group 6 = 3 groups of <u>2</u> |  6 blocks in all Make <u>2</u> equal groups. <u>3</u> blocks in each group 6 = 2 groups of <u>3</u> |  8 ducks in all Make <u>4</u> equal groups. <u>2</u> ducks in each group 8 = 4 groups of <u>2</u> |  8 sleds in all Make <u>4</u> equal groups. <u>2</u> sleds in each group 8 = 2 groups of <u>4</u> |  6 wagons in all Make <u>3</u> equal groups. <u>2</u> wagons in each group 6 = 3 groups of <u>2</u> | |

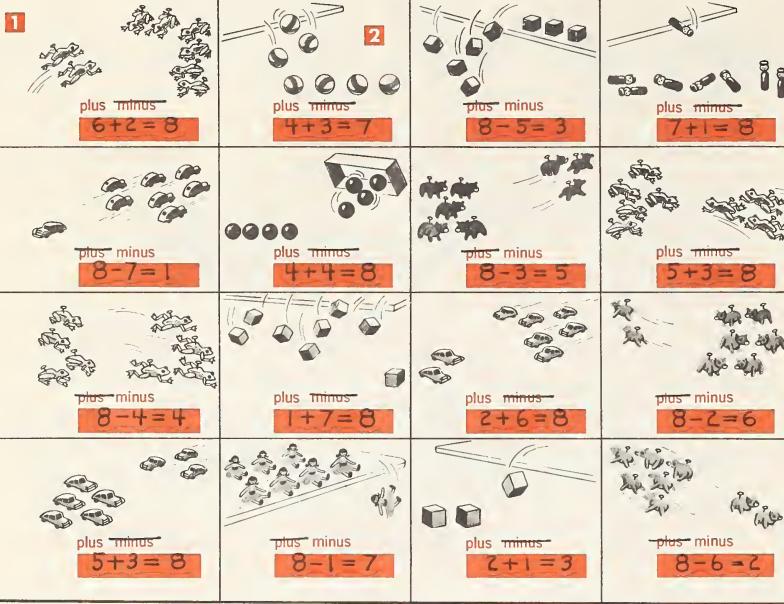
71

Tell the children to read the first expression in the first picture and the answer. Point out that the ten dots show how many groups there are to make. Have them write the numeral on the next answer line. Instruct the children to make equal groups by drawing a line from a doll to the first dot, from a doll to the second dot, and so on, until they have paired a doll to each dot. Then they are to draw a line from one of the remaining dolls to the first dot, and so on, until all the dolls have been paired. Have them read the next two expressions and write the answers.

Have the children follow the same procedure for each picture on the page.

In Exercises A to Q, the children are to write a numeral on the answer line or cross off a word that is not needed.

| | | | | | | |
|--|--|--|---|--|--|--|
|  8 dolls in all Make <u>4</u> equal groups. <u>2</u> dolls in each group 8 = 4 groups of <u>2</u> |  8 cars in all Make <u>4</u> equal groups. <u>2</u> cars in each group 8 = 2 groups of <u>4</u> |  6 balls in all Make <u>2</u> equal groups. <u>3</u> balls in each group 6 = 2 groups of <u>3</u> | 3 A 6 = 3 twos threes B 8 = <u>4</u> twos C 6 = <u>3</u> twos D 2 fours = <u>8</u> E 7 - 3 = <u>4</u> F 6 - 1 = <u>5</u> G 3 twos = <u>6</u> H 8 = 2 twos fours I 5 + 1 = <u>6</u> J 6 = 2 twos threes K 5 - 2 = <u>3</u> L 4 twos = <u>8</u> M 2 - 1 = <u>1</u> N 8 - 4 = <u>4</u> O 3 + 5 = <u>8</u> P 8 - 7 = <u>1</u> Q 8 = 4 twos dots | | | |
| <i>Other responses might be given. The ones shown are illustrative only.</i> | |  6 books in all Make <u>3</u> equal groups. <u>2</u> books in each group 6 = 3 groups of <u>2</u> |  6 blocks in all Make <u>2</u> equal groups. <u>3</u> blocks in each group 6 = 2 groups of <u>3</u> |  8 boats in all Make <u>2</u> equal groups. <u>4</u> boats in each group 8 = 2 groups of <u>4</u> |  6 sleds in all Make <u>4</u> equal groups. <u>2</u> sleds in each group 6 = 2 groups of <u>4</u> |  6 wagons in all Make <u>3</u> equal groups. <u>2</u> wagons in each group 6 = 3 groups of <u>2</u> |
|  8 ducks in all Make <u>4</u> equal groups. <u>2</u> ducks in each group 8 = 4 groups of <u>2</u> |  8 sleds in all Make <u>4</u> equal groups. <u>2</u> sleds in each group 8 = 2 groups of <u>4</u> |  6 wagons in all Make <u>3</u> equal groups. <u>2</u> wagons in each group 6 = 3 groups of <u>2</u> | 3 A 6 = 3 twos threes B 8 = <u>4</u> twos C 6 = <u>3</u> twos D 2 fours = <u>8</u> E 7 - 3 = <u>4</u> F 6 - 1 = <u>5</u> G 3 twos = <u>6</u> H 8 = 2 twos fours I 5 + 1 = <u>6</u> J 6 = 2 twos threes K 5 - 2 = <u>3</u> L 4 twos = <u>8</u> M 2 - 1 = <u>1</u> N 8 - 4 = <u>4</u> O 3 + 5 = <u>8</u> P 8 - 7 = <u>1</u> Q 8 = 4 twos dots | | | |



1 Get the children to notice that in some pictures a group of objects is being combined with another group and that in other pictures a group is being removed. Direct attention to the first picture. Ask the children to decide whether the action shown suggests the word plus or the word minus. Tell them to cross off the word that does not belong. Now ask how many frogs are sitting still, how many frogs are joining them, and how many there will be in all. Tell the children to write, in the green answer strip the numerals and signs that go with what is happening. [The children should write "6+2=8."]

2 Have the children follow the same procedure for each picture on the page.

- A 8 bears minus 1 bear are 7 bears.
 B 2 plants plus 4 plants are 6 plants.
 C 4 men plus 4 men are 8 men.
 D 7 girls minus 5 girls are 2 girls.
 E 8 mice minus 3 mice are 5 mice.
 F 5 dogs minus 1 dog are 4 dogs.
 G 8 birds minus 5 birds are 3 birds.
 H 2 pigs plus 6 pigs are 8 pigs.
 I 7 frogs plus 1 frog are 8 frogs.
 J 6 dolls minus 4 dolls are 2 dolls.
 K 2 cars plus 1 car are 3 cars.
 L 5 balls minus 2 balls are 3 balls.
 M 8 beds minus 2 beds are 6 beds.
 N 3 books plus 2 books are 5 books.
 O 4 tables plus 3 tables are 7 tables.
 P 8 boats minus 6 boats are 2 boats.
 Q 5 apples plus 1 apple are 6 apples.

1 A $6+2=8$
 B $8-7=1$
 C $7-4=3$
 D $5+3=8$
 E $4+2=6$
 F $5-3=2$
 G $7+1=8$
 H $8-4=4$
 I $2+6=8$
 J $5-4=1$
 K $3+5=8$
 L $7-3=4$
 M $8-6=2$
 N $1+7=8$
 O $3-2=1$
 P $8-5=3$
 Q $2+5=7$

2 A Subtract 2 from 8. $8-2=6$
 B Add 5 and 3. $5+3=8$
 C Subtract 6 from 7. $7-6=1$
 D Subtract 3 from 6. $6-3=3$
 E Add 3 and 4. $3+4=7$
 F Add 1 and 7. $1+7=8$
 G Subtract 1 from 8. $8-1=7$
 H Add 3 and 3. $3+3=6$
 I Subtract 3 from 8. $8-3=5$
 J Subtract 7 from 8. $8-7=1$
 K Add 4 and 4. $4+4=8$
 L Add 1 and 5. $1+5=6$
 M Add 6 and 2. $6+2=8$
 N Subtract 2 from 7. $7-2=5$
 O Add 3 and 5. $3+5=8$
 P Subtract 4 from 8. $8-4=4$
 Q Subtract 5 from 6. $6-5=1$

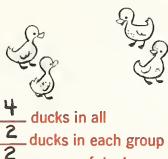
1 Direct attention to the first column of exercises. Tell the children read each exercise and write the correct numeral on the answer line.
 2 Have the children follow the same procedure for the second column exercises.

3 Direct attention to the last column of exercises. Tell the children to write on each answer line, the addition subtraction basic fact they must use to find the answer to the exercise. For Exercise A they should write "8-6=2." The children should do this work independently.

Direct attention to the first picture. Let the children to observe how many cows there are, how many are in each group, and how many there are in all. Tell them to write the correct numerals on the answer lines.

Tell the children to find the answers for the expressions in the other pictures in the same way. For a picture of the dogs, explain that they are to cross off the word that does not apply in the last line [fours].

Tell the children to read each exercise in the column at the right and then write the answer on the answer line or cross off the word that does not belong in the exercise.

| | | | |
|---|--|---|---|
|  1 2 groups of cows 2 cows in each group 4 cows in all $2 \text{ twos} = \underline{\quad 4 \quad}$ |  2 4 rabbits in all 3 rabbits running away 1 rabbit left $4 - 3 = \underline{\quad 1 \quad}$ |  3 3 pigs eating 1 pig running to eat 4 pigs will be eating. $3 + 1 = \underline{\quad 4 \quad}$ | 3 A $4 - 3 = \underline{\quad 1 \quad}$ B $2 + 5 = \underline{\quad 7 \quad}$ C $6 - 2 = \underline{\quad 4 \quad}$ D $1 + 3 = \underline{\quad 4 \quad}$ E $8 - 2 = \underline{\quad 6 \quad}$ F $2 \text{ twos} = \underline{\quad 4 \quad}$ G $2 + 6 = \underline{\quad 8 \quad}$ H $4 - 1 = \underline{\quad 3 \quad}$ I $6 - 2 = \cancel{\text{twos}} \text{ threes}$ J $2 + 2 = \underline{\quad 4 \quad}$ K $4 = 2 \cancel{\text{twos}} \text{ twos}$ L $7 - 1 = \underline{\quad 6 \quad}$ M $8 = \underline{\quad 2 \quad} \text{ fours}$ N $4 = \underline{\quad 2 \quad} \text{ twos}$ O $6 = 3 \text{ twos } \cancel{\text{threes}}$ P $3 + 1 = \underline{\quad 4 \quad}$ Q $4 - 2 = \underline{\quad 2 \quad}$ |
|  4 dogs in all 2 groups of dogs 2 dogs in each group $4 - 2 \text{ twos } \cancel{\text{fours}}$ |  2 horses eating 2 horses running to eat 4 horses will be eating. $2 + 2 = \underline{\quad 4 \quad}$ |  4 kittens in all 1 kitten running away 3 kittens left $4 - 1 = \underline{\quad 3 \quad}$ | |
|  4 ducks in all 2 ducks in each group 2 groups of ducks $4 = \underline{\quad 2 \quad} \text{ twos}$ |  1 chicken eating 3 chickens running to eat 4 chickens will be eating. $1 + 3 = \underline{\quad 4 \quad}$ |  4 bears in all 2 bears running away 2 bears left $4 - 2 = \underline{\quad 2 \quad}$ | |

5-78 FOUNDATION FOR USE OF RATIOS

Objectives

The idea of one-to-one correspondence, a basic concept in arithmetic, can be extended to include many other correspondences. Simple examples are one-to-two correspondence, two-to-three correspondence, nine-to-ten correspondence, or one-to-one hundred correspondence. For example, suppose that in a collection of balloons, 2 balloons out of each 3 are red, and 1 balloon out of each 3 is blue. Then there are 2 red balloons for each blue balloon, and a 2-to-1 correspondence can be made between the members of the group of red balloons and the members of the group of blue balloons. Or suppose that out of every 5 balloons in a collection 2 are green and 3 are yellow. A 2-to-3 correspondence can be set

up between the members of these two groups.

Correspondence can be set up between groups of objects that are quite different. Thus, suppose there are 10 toys for a group of 5 children. Then subgroups may be made from each of these groups so that 2 toys go with, or correspond to, each child. Toys can be distributed at the rate of 2 toys per child. It is relatively easy to see the relationship of the two groups (all the toys and all the children) when it is expressed in its simplest form—that is, 2 toys to 1 child, rather than 10 toys to 5 children or 100 toys to 50 children.

On pages 75-77, the children extend and generalize their idea of correspondence. They learn to separate two groups into subgroups so

that the correspondence between the two groups is recognizable in its simplest form.

Preliminary Teaching

Before the children use Worksheets 75-78, they should be able to discriminate between situations in which a number of equal groups possess similar characteristics and situations in which they do not. They should be able to separate two groups into the same number of subgroups that possess similar characteristics throughout. They should know when, and under what conditions, they can make such statements as: "2 balls out of 3 are red," "3 large boxes for every 5 small boxes," etc.

You will need a collection of small objects (jacks of different colors; markers of different shapes, sizes, or colors; blocks, toy airplanes, pencils,

etc.) to use with the following activities.

First, the children learn to recognize situations in which there are equal subgroups of equal groups. Examples of this type of situation are: 2 out of every 3 balls are yellow; 3 out of every 5 blocks are large; 1 out of every 3 airplanes is small.

Set up five groups, each with similar subgroups, on a table where all the children can see them. For example, set up five groups of 3 balls; of each 3 balls, 2 are red and 1 is green. By questioning get the children to see that the balls are arranged in equal groups, and let them discover the differences and similarities of objects within the groups. Discourage discussion of the total number of objects on the table.

Proceed with questions and directions such as: "How are the balls arranged? [In groups of 3] Are the groups of balls alike in any way? [There are 2 red balls in each group.] Can you say that 2 balls out of each group of 3 balls are red? Is there any other way in which the groups of balls are alike? [Work for responses like 'There is 1 green ball in each group,' '1 ball out of each group of 3 balls is green,' '1 out of 3 is green,' 'There is 1 green ball for every 2 red balls.'])"

Set up other such collections of objects and proceed in a similar way. Include some groups with characteristics that are not common to all the groups. For example, in a set of groups of dolls, 2 dolls out of each 5 dolls might be wearing hats. In all the groups but one, 4 dolls out of 5 dolls could be sitting and the other one lying down. In the one different group, all the dolls should be sitting. After establishing that 2 dolls out of each five dolls are wearing hats, ask: "What else can you say about the dolls? [3 dolls out of 5 dolls are not

wearing hats.] Can you say that 4 out of 5 dolls are sitting? Why not?" Some children may want to say: "But at least 4 dolls in each group are sitting." Try to get them to understand that, although this is true, it is not the same kind of statement they have been making, because in one group *all* the dolls are sitting.

Be sure the children understand clearly that no characteristic can be selected as a common characteristic unless it is true of every group. That is, if they notice that 2 tops in a group of 5 tops are large, they must be sure to check every group of 5 tops to see if it contains just 2 large tops before they can say "2 tops out of each 5 tops are large."

Give each child a collection of 12 or 15 small objects, one third of which are different in size, color, or shape from the rest but are similar to one another. Examples of appropriate collections are: 8 green markers and 4 yellow markers; 10 round markers and 5 square markers; 8 blue cards and 4 white cards. Ask the children to arrange their collections in groups of 3 in such a way that each group is exactly like every other group. Then let each child make statements about another child's arrangement: "1 marker out of each 3 markers is yellow," "2 markers out of each 3 are green," "2 markers out of each 3 are round," and so on.

[Worksheet 75 can be used at this point.]

Next, the children learn to determine whether or not they can distribute two series of unlike objects (of unequal number) into the same number of groups so that (1) an equal number of one kind of object is in each group, and (2) an equal number of another kind of object is in each group. They then learn to make comparisons between the quantities by such statements as: "There are 2 air-

planes for each 3 boys," and "There are 2 for 3."

First, set up four or five groups of objects on a table where all the children can see them. These groups should be composed of equal subgroups of unlike objects. For example, you might use sets of 2 dolls and 3 doll chairs. Proceed somewhat as follows: "Look at the groups on the table. How many dolls are there in each group? [2] How many chairs are there in each group? [3] What can you say about the dolls and the chairs? [There are 2 dolls for each 3 chairs, and there are 3 chairs for each 2 dolls.]"

Now, set up two series of equal groups, but do not combine them. Ask: "How are the boxes arranged? [In groups of 3] How are the toy dogs arranged? [In groups of 2] Is there a group of boxes for each group of dogs? [There are 3 boxes for each 2 dogs.] What else can you say about the boxes and the dogs? [There are 2 dogs for each 3 boxes.]" Repeat this activity several times with different sets of groups of unlike objects.

Next, set up three or four equal groups of one kind of object (for example, four groups of three airplanes each). Nearby put a group of another kind of object (blocks). The number of blocks should be a multiple of the number of groups of airplanes. Now ask: "How many groups of airplanes are there? [4] How many airplanes are in each group? [3] How many groups of blocks are there? [1] How many blocks are there for each group of 3 airplanes? How can we find out?"

Get the children to suggest that the blocks be distributed one by one to the groups of airplanes until all the blocks have been used. Let a child do this. Then ask: "How many blocks were put with each group of

planes? What can you say now about the blocks and the airplanes?" Repeat this activity several times. Then use a group that cannot be distributed equally among the organized groups and let the children discover that they cannot say, "There are 3 balls for every 2 pencils." Repeat these activities until you are sure the children understand the principles involved.

Finally, ask 6 children to arrange themselves in groups of 2 or groups of 3. When they have done this, provide an appropriate number of objects (books, pencils, toys, etc.) and ask them to arrange these objects so that there is an equal group of objects for each group of children. The children should understand at this point that the groups of objects must be equal in number. Then have several children in turn make statements like "There are 3 books for each 2 children," "There are 2 children for each book," "There are 3 for 2," etc. [Worksheet 76 can be used at this point.]

Use activities like those suggested for both Worksheet 75 and Worksheet 76, and get the children to organize the two different types of situations (2 big balls out of every 5 balls, and 2 balls to every 5 blocks). Give them practice in distinguishing between these situations and in making the appropriate statement for each situation.

[Worksheets 77 and 78 can be used at this point.]

75 Comments

On this page the child examines groups of objects to determine whether or not they are made up of equal subgroups with common characteristics.

To introduce this page, write on the board several sets of statements

like those on page 75. Place groups of objects that fit the first statement on a table, and ask questions that will help the children decide what numerals belong on the answer lines. Let a child write the numerals on the answer lines. Continue until you are sure the children understand what they are to do. Then have them turn to page 75. Work with the children on the first two or three exercises.

76 Comments

On this page the child learns to distribute two unequal groups of unlike objects into the same number of groups so that (1) an equal number of one kind of object is in each group, and (2) an equal number of the other kind of object is in each group.

To introduce this page, arrange 15 boxes or paper cups in a circle and put 9 markers within the circle. Ask a child to arrange the boxes in groups of 5. Then ask another child to distribute the markers equally among the groups of boxes by pushing a marker over to each group of boxes in turn, then repeating this process until all the markers have been used. Ask the children how many markers there are with each group of boxes. Get them to observe that there is an equal number of markers with each group of 5 boxes. Write "3 markers for each group of 5 boxes" on the board.

Now, change the number of boxes and the number of markers and write an expression on the board like one of those on page 76. Be sure to include an answer line. The expression must be applicable to the group of markers and the group of boxes you have just set up. Ask the children what they think they are to do and, if possible, let them work it out themselves. Let one child put the boxes in groups of the size indicated in the

expression on the board, and let another child distribute the markers and write the correct numeral on the board. Repeat this activity once more, but this time use a group of markers that cannot be equally distributed among the groups of boxes. Let the children distribute the markers and discover that they cannot be arranged in equal groups to correspond to the groups of boxes. Explain that the expression on the board must be crossed off.

Tell the children to open their books to page 76. Help them with at least the first two pictures.

77 Comments

On this page the child gets more experience with the two types of situations expressed by ratios that were introduced on pages 75 and 76.

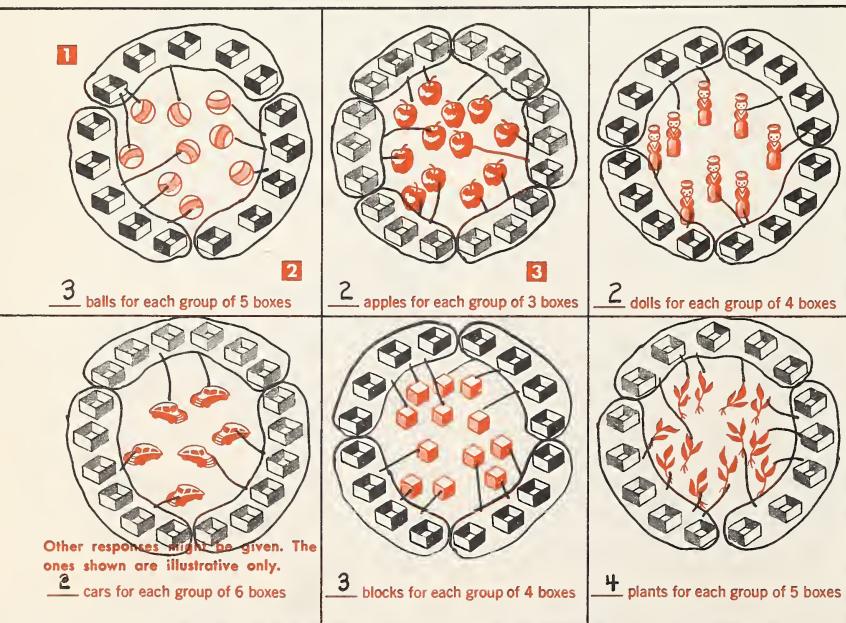
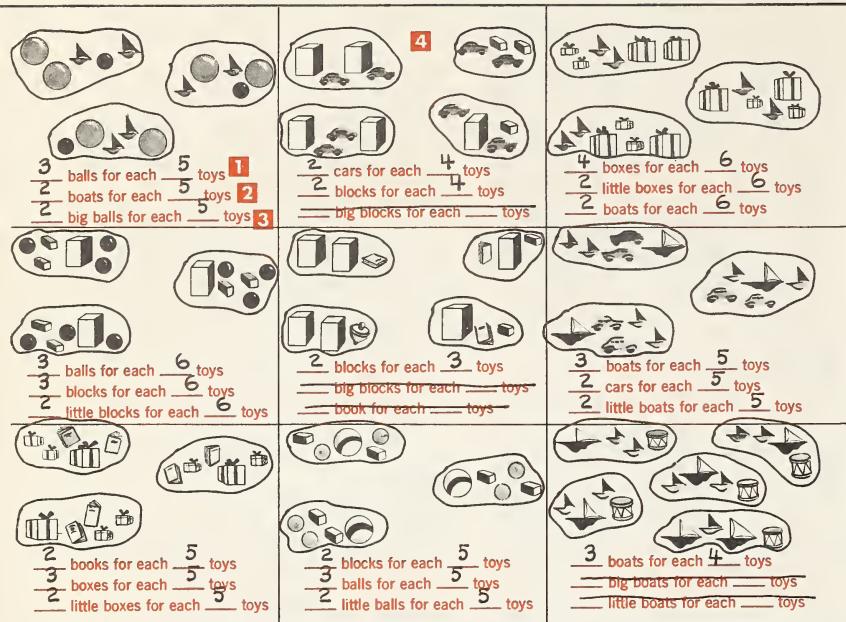
If the activities suggested in "Preliminary Teaching" have been used, and if pages 75 and 76 were introduced as suggested in the "Comments" for those pages, no special activity should be needed to introduce this page.

Ask the children to open their books to page 77. Let them examine and discuss the page. Work with them on the first two pictures; then let them finish the page independently.

78 Comments

This page provides practice in the solution of pictorial problem situations and on the addition, subtraction, multiplication, and division basic facts the children have learned up to this point.

All the exercises on this page are similar to ones the children have done before. No special introduction should be necessary. When they have finished, you may wish to let them compare and discuss their work.



1 Point out the three groups of toys in the first picture, and have the children draw a ring around each group. Have the children read the first expression and decide that each group has balls in it and that each group has the same number of balls. Tell them to write on the first answer line the numeral that stands for the number of balls. On the second answer line they are to write the numeral that represents the number of toy in all in each group.

2 Adapt Note 1 and use with the second expression. Tell the children that if they find an expression that cannot be answered, they are to cross it off.

3 Adapt Note 1 and use with the third expression.

4 Repeat the same procedure with each of the other pictures on the page.

1 Point out what the expression in the first picture says [that the box should be put in groups of 5]. Tell the children to draw a ring around many groups of 5 boxes each as they can.

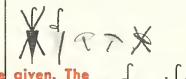
2 Tell the children to try to put the same number of balls with each group of boxes. Direct them to draw a line from a ball to a group of boxes, another line from another ball to another group of boxes, etc., until all the balls have been used. Have the children make sure that there is the same number of balls with each group of boxes. Then have them write the numeral for that number on the answer line.

3 The children should follow the same procedure for each picture on the page.

77

Explain that the words printed in each picture tell what should be in each group in the picture. In each group the children are to cross off enough of one (or both) kinds of object to make the statement true. Some groups are already limited to the number of each kind of object specified in the expression, and they should be left as they are.

Work through the first two pictures with the children; then let them finish independently. When they have finished, let them compare and discuss their work.

| | | | |
|---|---|---|---|
|  1 2 apples for each 3 bags |  2 2 big boxes for each 4 boxes |  3 3 little balls for each 5 balls |  2 2 boxes for each 3 cans |
|  4 4 sleds for each 3 dolls |  5 5 boxes for each 2 wagons |  1 1 long umbrella for each 3 umbrellas |  4 4 little baskets for each 5 baskets |

78

Tell the children to read the expressions in each picture and use the picture to find the numerals that belong on the answer lines.

In Exercises A to Q the children should either write the answers on the lines or cross off the words that do not apply.

| | | | |
|---|--|--|---|
|  1 3 bears in all 1 bear going away 2 bears left $3 - \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$ |  1 6 horses eating 2 horses running to eat 8 horses will be eating. $6 + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$ |  1 4 cows eating 3 cows running to eat 7 cows will be eating. $4 + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$ | 2 A 6-1= <u>5</u> B 4 twos= <u>8</u> C 8-1= <u>7</u> D 4= <u>2</u> twos E 5+1= <u>6</u> F 8=4 twos four G 2+2= <u>4</u> H 2+6= <u>8</u> I 8-7= <u>1</u> J 2 twos= <u>4</u> K 6=3 three twos L 1+3= <u>4</u> M 2 fours= <u>8</u> N 1+7= <u>8</u> O 4=2 two twos P 8-5= <u>3</u> Q 3+1= <u>4</u> |
|  1 3 groups of dogs 2 dogs in each group $6 - \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$ |  1 7 pigs in all 4 pigs going away 3 pigs left $7 - \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$ |  1 2 groups of pigs 4 pigs in each group 8 pigs in all $2 fours = \underline{\hspace{2cm}}$ | |
|  1 6 cows in all 4 cows going away 2 cows left $6 - \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$ |  1 2 groups of horses 4 horses in each group 4 horses in all $2 twos = \underline{\hspace{2cm}}$ |  1 5 dogs playing 2 dogs running to play 7 dogs will be playing. $5 + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$ | |

79-87 THE BASE-TEN SYSTEM OF NUMERATION TO 999

Objectives

Any number, no matter how large, can be symbolized by using the ten numerals and the principles of the base-ten system of numeration. When 10 tens is reached in the counting process, we use the word *hundred*. If the children understand the principles of the base-ten system, if they learn to use this new word, and if they understand what it tells them about 10 groups of ten and place value, they can easily read and write numerals to 999. Use of the word *hundred* simplifies the reading of numerals. For example, 496 could be read "forty-nine tens, six," but "four hundred ninety-six" is the form we use.

Children must understand that the word *hundred* always refers to 10 tens and that it must be preceded by another number name, from one to nine, to tell how many groups of 10 tens there are. They must learn how hundreds are indicated by place value in written symbols. They must learn also how to extend what they know about the base-ten system from 1 to 99 to include the numerals from 99 to 999. When 999 is reached, the word *thousand*, meaning 10 hundreds, is introduced. The base-ten system beyond 999 is not dealt with in Our Number Workshop 2.

Preliminary Teaching

The children already know how to group by tens and ones, how to count by tens and ones, how to use tally marks to show tens and ones, and how to translate the tally marks correctly into numerals that represent the numbers to 99. They must learn to group and count by hundreds, tens, and ones; to use tally marks to show hundreds, tens, and ones; and to translate the tally marks into numerals that represent the numbers to 999.

You will need a large quantity of peg sticks, straws, etc., that can be grouped in bundles of 10, so that these can, in turn, be grouped in piles of 10 tens.

Since this section (Worksheets 79-87) is organized in the same way as the previous section on the base-ten system (Worksheets 29-36), the same types of activities can be used for the preliminary teaching. The suggestions here, therefore, are restricted to references to pages in this Teaching Guide and a brief statement of how the idea taught previously is to be extended.

Worksheets 79, 80, and 81 are similar to Worksheets 29 and 30. Adapt the activities suggested in "Preliminary Teaching" on pages 35-36 to teach the children to make groups of hundreds, tens, and ones; to tally them so that they show place value; then to translate the tally marks into numerals.

[Worksheets 79, 80, and 81 can be used at this point.]

Worksheet 82 is similar to Worksheet 31. Use activities like those suggested in "Preliminary Teaching" for Worksheet 31 on pages 36-37 of this Teaching Guide to teach the children to count and write hundreds in numerical order.

[Worksheet 82 can be used at this point.]

Worksheet 83 is also similar to Worksheet 31. Use activities like those suggested in "Preliminary Teaching" for Worksheet 31 on pages 36-37 of this Teaching Guide to teach the children to count and write hundreds and tens in numerical order.

[Worksheet 83 can be used at this point.]

Worksheet 84 is similar to Worksheet 34. Use the same type of activity suggested in "Preliminary Teach-

ing" for Worksheet 34 (see page 37 of this Teaching Guide) to teach the children to count and write hundreds, tens, and ones in numerical order.

[Worksheet 84 can be used at this point.]

Worksheet 85 is similar to Worksheet 35. Use the same type of activity suggested in "Preliminary Teaching" for Worksheet 35 (see page 38 of this Teaching Guide) to teach the children how to change the number symbol when the quantity it represents is increased by 1, 10, and 100.

[Worksheet 85 can be used at this point.]

Worksheets 86 and 87 are similar to Worksheet 36. Adapt the activities suggested in "Preliminary Teaching" for Worksheet 35 (on page 38 of this Teaching Guide) to teach the children how to change the number symbol when the quantity it represents is decreased by 1, 10, and 100.

[Worksheets 86 and 87 can be used at this point.]

79 Comments

On this page the child learns to group by hundreds, tens, and ones; to make tally marks for the groups to show place value; and to write three-digit numerals in place of the tally marks.

Since this page is like Worksheets 29 and 30, except that the exercises are extended to include groups of 10 tens, or hundreds, the "Comments" for Worksheets 29 and 30 (on page 38 of this Teaching Guide) apply to Worksheet 79 also.

80 Comments

On this page the child continues the work begun on Worksheet 79.

Since Worksheet 80 is similar to Worksheets 29 and 30, the "Com-

ents" for Worksheets 29 and 30 (on page 38 of this Teaching Guide) apply to this page also.

31 Comments

In this page the child continues the work done on pages 79 and 80.

This page is similar to the two preceding pages. Here, however, since the objects are already arranged in tens of 100, the children will not need to encircle each group of 100. Be sure they understand and accept the pyramids as groups of 100 before they begin to make their tally marks.

32 Comments

In this page the child learns the names and symbolism of the hundreds. He learns to say and write the numerals in proper sequence. He also learns the function of the numeral zero in the tens' column.

This page is similar to Worksheet 1, but it deals with hundreds. The "Comments" for Worksheet 31 (on pages 38-39 of this Teaching Guide) apply to this page also.

33 Comments

In this page the child learns the names and the symbolism of the first number in each decade between 200 and 300, and between 100 and 200.

This page is like Worksheets 31 and 82, but it deals with decades within the hundreds. Adapt the "Comments" for Worksheet 31 (on pages 38-39 of this Teaching Guide) to fit the exercises on Worksheet 33. The first picture should show 210 pieces of candy, the second (working horizontally) 220, and so on through 290. Rows A to E at the bottom of the page should show the names of the first number in each decade between 100

and 200 in proper sequence, starting with the numeral at the beginning of the line.

84 Comments

On this page the child learns that the symbolism of the numbers in any hundred goes through the same sequence from 1 to 9 in the ones' column, the tens' column, and the hundreds' column.

This page is like page 34, except that it deals with the symbolism of numbers within hundreds from 100 to 900. The "Comments" for Worksheet 34 (on page 39 of this Teaching Guide) apply to this page also.

85 Comments

On this page the child learns how to change the number symbol when the quantity it represents is increased by 1, 10, and 100.

This page is like page 35, but it deals with hundreds. The "Comments" for Worksheet 35 (on page 39 of this Teaching Guide) apply to this page also.

86 Comments

On this page the child learns how to change the number symbol when the quantity it represents is decreased by 1, 10, and 100.

This page is like page 36, but it deals with hundreds. If any reteaching is necessary, adapt the suggestions in "Preliminary Teaching" for Worksheet 35 (page 38 of this Teaching Guide).

87 Comments

On this page the child learns how a number symbol is changed when the quantity it represents is decreased by hundreds, tens, and ones.

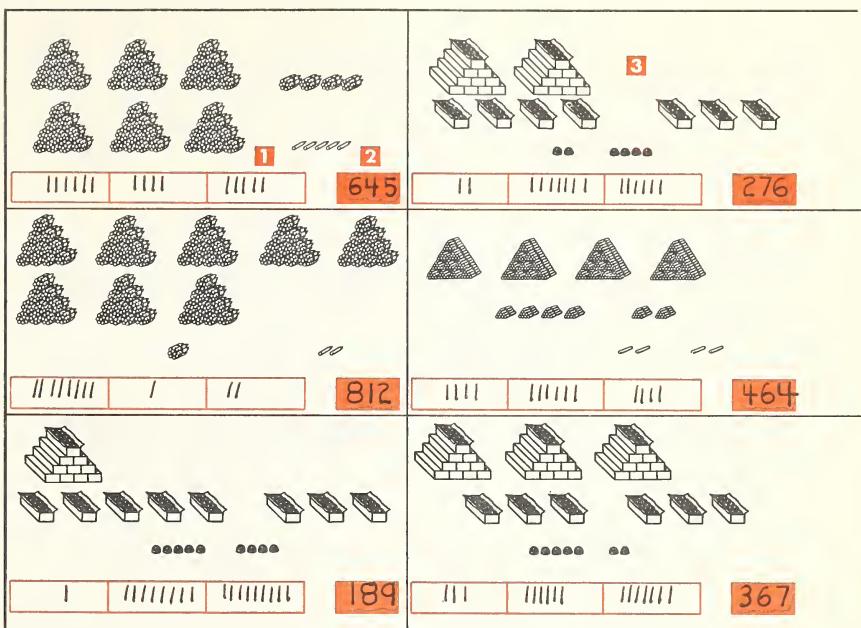
This page continues the work begun on the previous page. Here the child decreases the quantity shown in each picture by crossing off enough hundreds, tens, and ones to show the number of objects indicated by a numeral in the corner of the picture.

81

Point out to the children that since the objects on this page are arranged in groups of hundreds, tens, and ones, they need not encircle groups of 100 as on the preceding pages. Have them make tally marks for the hundreds, tens, and ones in the white answer space.

Tell the children to write a numeral in the brown answer space in place of the tally marks.

Have the children follow the same procedure for each picture on the page. Let them discuss and compare their answers.



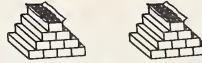
82

Tell the children that there are 100 sticks in each pyramid. Tell them that they are to cross off enough pyramids of 100 in the first picture so that it will show just 100 sticks. Then they are to write in the brown answer space the numeral [100] that tells the number of sticks.

In each picture on the page, have the children cross off enough pyramids of sticks to make it show 100 more sticks than the picture before it and write the numeral in the answer space. They should work across the page. Point out that in some pictures no pyramids need to be crossed off.

Direct attention to Rows A to E. Tell the children they are to start with the first numeral in each row, cross off numerals that are not in the proper sequence, and insert numerals that are missing. They should end with the numeral 900.

| | | | | | | |
|------------|-------------|---|---------------------|-------------|-------------|-----|
| 1 | 2 | Other responses might be given. The ones shown are illustrative only. | | | | |
| 100 | 200 | 300 | | | | |
| 1 | 2 | 3 | | | | |
| 400 | 500 | 600 | | | | |
| 1 | 2 | 3 | | | | |
| 700 | 800 | 900 | | | | |
| 3 A | 100 200 300 | 200 400 500 | 800 | 600 | 700 800 900 | |
| B | 300 | 400 500 600 | 200 | 700 800 | 900 | 700 |
| C | 100 | 200 300 400 | 700 | 500 600 700 | 800 400 | 900 |
| D | 100 | -500- | 200 300 400 500 600 | 400 | 700 800 200 | 900 |
| E | 200 | 300 400 800- | 500 | 400 600 700 | -100 800 | 900 |

| | | | | | |
|--|------------|---|--|---|------------|
|  | 1 |  | 2 |  | |
|  | 210 |  | 220 |  | 230 |
|  | 240 |  | <small>Other responses ones shown are illustrative only.</small> |  | 250 |
|  | 260 |  | |  | 270 |
|  | 280 |  | |  | 290 |
| A 120 130 140 150 160 170 | | | | +10- 180 190 | |
| B 110 120 130 140 150 160 | | | | 170 180 190 | |
| C 110 120 130 140 150 160 170 | | | 180 | -10- 190 | |
| D 120 130 140 150 160 170 180 | | | | +10- 190 | |
| E 120 130 140 150 +70- 170 180 190 | | | | 160 170 180 190 | |

| | | | | | |
|--|--|--|-----------------|------------------------------|--|
| 1 A 425 426 427 421 428 429 | | | | +40- 430 431 432 433 434 435 | |
| 2 B 752 757 753 754 755 756 757 758 | | | 759 | -763- 760 761 762 763 | |
| C 966 -965- 967 970 968 969 | | | | +74- 970 971 972 973 | |
| D 141 142 143 144 148 145 146 147 148 | | | | -155- 149 150 | |
| E 800 801 802 800 803 804 805 806 | | | -811- 807 | 808 809 810 811 | |
| F 219 220 221 222 226 223 224 225 | | | | +224- 226 227 | |
| G 596 597 598 599 600 601 602 | | | -604- | 603 604 605 | |
| H 189 190 191 194 192 193,194,195,196,197 | | | 198 199 200 201 | | |
| I 340 346 341 342 346 343 344 346 345 348 346 347 | | | | | |
| J 815 816 819 817 818 819 820 | | | -825- | 821 822 | |
| K 657 658 659 667 660 661 662 | | | -667- | 663 664 665 666 | |
| L 470 478 471 472 473 474 478 475 476 | | | -478- | 477 | |

3

1 Tell the children that they are to cross off enough boxes of 10 candies in the first picture to make it show 210 pieces of candy. Then they should write the numeral in the brown answer space.

2 In each picture on the page, have the children cross off enough boxes of candy to make the picture show 10 more than the preceding picture. They should write in the answer space the numeral represented. They should work across the page.

3 Call attention to Rows A to E at the bottom of the page. Have the children start with the first numeral in each row, cross off numerals that are not in the proper sequence, and insert numerals that are missing.

1 Direct attention to Row A. Tell the children they are to start with the first numeral shown, cross off numerals that are not in the proper sequence, and insert numerals that are missing. They should end the sequence with the last numeral shown. Work through Row A with the children.

2 Have the children arrange and insert numerals in Rows B to L in the same manner.

3 When the children have finished, let them compare and discuss their work.

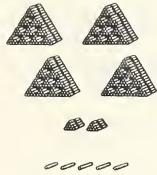
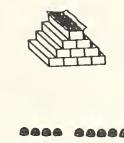
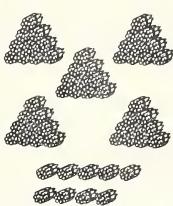
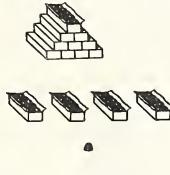
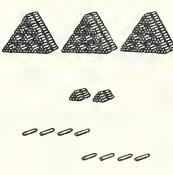
85

Direct attention to the first picture. Tell the children to decide how many objects are shown and to write the numeral on the first brown answer line. Then tell them they are to imagine that the number of objects increased first by 1, then by 10, and finally by 100. They should write new numerals on the other brown answer lines.

Have the children follow the same procedure for each picture.

For each exercise in A to Q, the children are to write on the first brown line the numeral that represents more than the numeral shown; on the next brown line the numeral that represents 10 more than the numeral shown; and on the last line the numeral that represents 100 more than the numeral shown.

Let the children compare and discuss their work.

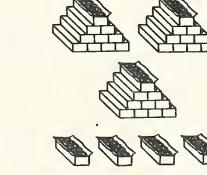
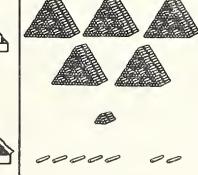
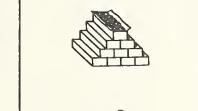
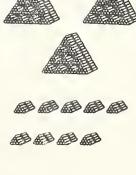
| | | | |
|---|---|---|--|
|  |  |  | A 322 323 3 332 422 B 189 190 199 289 C 610 611 620 710 D 559 560 569 659 E 278 279 288 378 F 701 702 711 801 G 525 526 535 625 H 400 401 410 500 I 777 778 787 877 J 639 640 649 739 K 419 420 429 519 L 145 146 155 245 M 309 310 319 409 N 832 833 842 932 O 620 621 630 720 P 301 302 311 401 Q 299 300 309 399 |
|  |  |  | 4 |

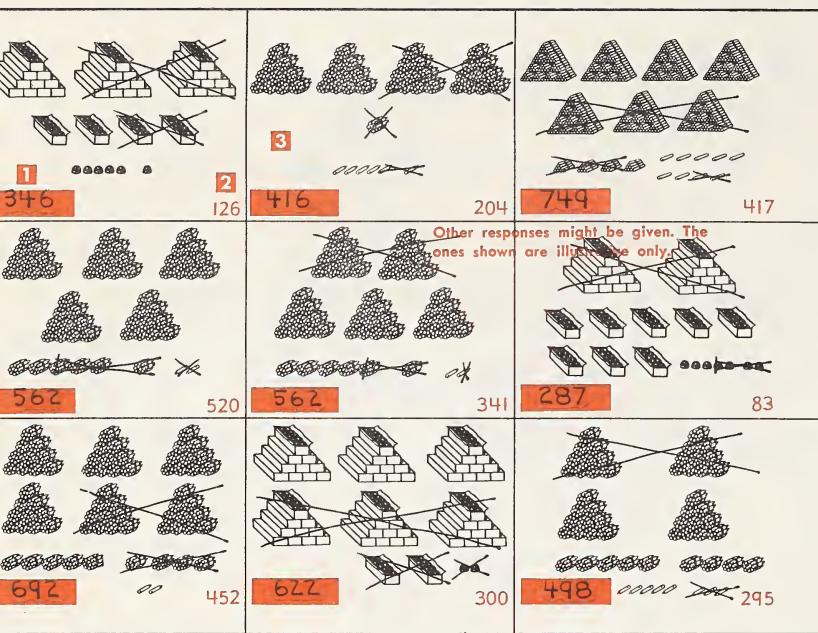
86

Direct attention to the first picture. Tell the children to decide how many objects are shown and to write the numeral on the first brown answer line. Then tell them to imagine that the number of objects is decreased first by 1, then by 10, and finally by 100. They should write the new numerals on the other answer lines.

Have the children follow the same procedure for each picture.

Point out that for each exercise in A to Q there is a numeral and three brown answer lines. The number is to be decreased by 1 and the new numeral written on the first brown line; then the original number is to be decreased by 10 and the numeral written on the second line; then the original number is to be decreased by 100 and the numeral written on the third brown line. Let the children compare and discuss their work.

| | | | |
|---|---|---|--|
|  |  |  | A 551 550 3 541 451 B 300 299 290 200 C 860 859 850 760 D 537 536 527 437 E 990 989 980 890 F 215 214 205 115 G 737 736 727 637 H 829 828 819 729 I 599 598 589 499 J 630 629 620 530 K 416 415 406 316 L 401 400 391 301 M 555 554 545 455 N 294 293 284 194 O 381 380 371 281 P 902 901 892 802 Q 207 206 197 107 |
|  |  |  | |



1 Direct attention to the first picture. Tell the children to decide how many objects are shown and to write the numeral in the brown answer space.

2 Call attention to the brown numeral in the lower right corner of the picture. Tell the children to cross off enough objects so that the picture will show that number of objects.

3 Have the children follow the same procedure for each picture on the page. Let the children compare and discuss their work.

88-93 MONEY: COUNTING BY FIVES; THE QUARTER

Objectives

Since the nickel is equal in value to five cents, and the quarter is equal to five nickels, children need to learn to count by fives if they are to count money efficiently.

First, collections of pennies arranged in groups of five should be counted by fives so that the child will be aware that he is shortening the counting process. Then collections of coins including nickels and pennies (in groups of five) should be counted by fives. Next, extra pennies, to be counted by ones, should be included with the groups of five.

The quarter should be introduced, and various ways of using coins of smaller value to make up twenty-five cents should be explored. Finally, collections of coins that include pen-

nies, nickels, dimes, and one quarter should be counted. The coins should be arranged so that the children can start with the quarter and say "twenty-five cents," then count by tens, fives, and ones.

Worksheet 88 is devoted to general problem situations in which addition and subtraction basic facts are related to money. The other pages develop the ability to count money by tens, fives, and ones.

Preliminary Teaching

Before using Worksheets 88-93, the children should be able to apply number ideas to situations involving money, and they should be able to count money by tens, fives, and ones.

You will need to have on hand about 50 pennies, 10 dimes, 10 nick-

els, and one quarter. Children who can bring a few coins of those denominations from home should do so. Play money is a very poor substitute.

First, set up problem situations like those on page 88. Use small toys, price tags, pennies, and dimes. Some typical situations might be: "A toy costs 7 cents. There is a dime to pay for it. How much money will be left?" "A pad of paper costs 10 cents. There are 6 pennies to pay for it. How many more pennies are needed?" "There are 3 dimes and 8 pennies on the table. How many more pennies are there than dimes?" (Be sure the children understand that they are comparing the number of coins, not the value.) "There are three groups of 2 pennies each. How many pennies are there in all?" "7 pennies are on the table. 4 are taken away. How many will be left?"

For each situation, write on the chalkboard sentences like those on page 88. Let the children take turns in writing the responses on the board while one child manipulates the coins on the table. The rest of the children can perform the action at their desks, preferably with their own coins. If they do not have coins, let them use any money or markers to represent coins. Through questions and the sentences written on the board, get the children to see that the arithmetic facts they have learned can be used in situations involving money. Have them say the basic fact involved in each problem after each situation has been worked out.

[Worksheet 88 can be used at this point.]

Put a collection of not more than 50 pennies on a table. Have one child come to the table to count pennies and another child go to the board. Let the rest of the children perform the action at their desks, using their own real pennies, markers, or play money. Tell the child at the table to count the pennies by ones and stack them in groups of 5 as he counts. Each time a group of 5 is counted, have the child at the board write the numeral. If the child counting the pennies must make the groups of 5 first, and then count them, permit him to do so. He, of course, should count "one, two, three, four, five, six," etc. while the child at the board writes, at the appropriate time, "5, 10, 15, 20, 25," etc. It will be helpful to the child who is writing the numerals on the board if the child who is counting hesitates slightly after saying the number for each group of 5.

When the series of numerals on the board reaches 50, ask the children what they notice about these numerals. Try to get them to see that counting by fives means starting with 5, then going immediately to 10, and

thereafter saying the "five" number of each decade, then the first number of the next decade, and so on. If they understand this principle, counting by fives will be very easy for them to learn. Next, point to the stacks of 5 pennies, and ask the children if they can think of a quick way to count them. Remind them that there are 5 pennies in each group. If necessary, ask them what the numerals on the board stand for. They should remember that they were put there as each group of 5 pennies was counted. Let several children count the stacks of pennies by fives. If possible, they should do this without referring to the numerals on the board. All the children should practice counting their own stacks of pennies or markers by fives.

Next, ask a child to count the pennies again by fives, and as he counts each stack, take it away and put a nickel in its place. Ask the children if the nickels can be counted in the same way and why. They should understand that a nickel and five pennies are equal in value. Let them practice counting nickels by fives. These amounts should be made up of both nickels and stacks of five pennies.

[Worksheet 89 can be used at this point.]

Use activities similar to those suggested above to teach the children to count by fives and ones. First, have them count collections of coins made up of nickels, stacks of 5 pennies, and single pennies (fewer than 5). Next, have them count collections made up of pennies and nickels. Let them organize the pennies into as many groups of 5 as they can, then count these groups and the nickels by fives, and any extra pennies by ones.

[Worksheet 90 can be used at this point.]

Use activities similar to those suggested above to teach the children

the value of the quarter in relation to the dime, nickel, and penny. They should practice assembling a collection of coins worth twenty-five cents in as many different ways as they can.

Also give them some experiences in counting money by tens, fives, and ones.

[Worksheet 91 can be used at this point.]

Use real coins to teach the children to count amounts of less than one dollar, starting with a quarter and counting by tens, fives, and ones as the situation demands. Occasionally omit the quarter, and let the children start counting with a dime or a nickel. If a quarter is included, they should count it first.

[Worksheets 92 and 93 can be used at this point.]

88 Comments

On this page the child learns to use money in problem situations that involve addition, subtraction, multiplication, and division.

If the activities suggested in "Preliminary Teaching" have been used, no special activities will be needed to introduce this page. Ask the children to look at the page and tell what they think they are to do. Be sure they understand that while the pictures do not always show the children mentioned in the problems, there is a picture for each problem.

89 Comments

On this page the child counts nickels and pennies by fives.

If the activities suggested in "Preliminary Teaching" for this page have been used, no other special introduction will be needed.

Ask the children to look at Worksheet 89 and tell what the coins with

the numeral 5 on them stand for and what the coins with the numeral 1 on them stand for. Be sure they observe that the pennies are shown in groups of 5. They are to count the coins by fives and for each five draw a ring around the brown numeral that represents the amount counted to that point.

90 Comments

On this page the child counts pennies and nickels by fives and ones.

If the activities suggested in "Preliminary Teaching" for Worksheet 90 have been used, no other special introduction will be needed. The children should be familiar by now with the symbols used for nickels and pennies. They are to count the coins by fives and ones and write the numerals as they count. Then they should write the total amount in the brown answer strip.

91 Comments

On this page the child practices counting money by tens, fives, and ones. He also encircles groups of coins that are equal in value to a quarter.

If the activities suggested in "Preliminary Teaching" for this worksheet have been used, no special introduction will be needed.

The children are to do two things with the exercises on this page. First, they count the money shown by tens, fives, and ones and write the numerals for the amount in the brown answer space. Next, in each picture they draw rings around as many groups of coins worth twenty-five cents as they can. When they start this part of the work, explain that each coin may be used in only one group.

Bright or average children can do both parts of each exercise before going on to the next picture. Slower children will find it easier to count the

money in all the pictures first; then encircle the groups in all the pictures. If these children need extra help, draw on the chalkboard groups of coins worth twenty-five cents for their reference as they work.

Since, in most of the pictures, the coins can be grouped in several ways to make twenty-five cents, the children should compare and discuss their work.

92 Comments

On this page the child learns to count coins by starting with a quarter, then counting by tens, fives, and ones.

Worksheet 92 is like Worksheet 90, except that it includes quarters and dimes. If the activities suggested in "Preliminary Teaching" for Worksheet 92 have been used, no other special introduction should be needed. Be sure the children understand that they are to count the coins by groups if they overlap—that is, two nickels that overlap are to be counted as ten cents, and five pennies that overlap are to be counted as five cents. As the children count each coin or grouping of coins, they are to write the accumulated amounts on the brown lines in the pictures. The work will be easier if they cross off each coin or group of coins as they count. The total amount of money represented in the picture is to be written in the brown answer space. The cent sign must be written after this numeral.

93 Comments

On this page the child counts money in specified amounts.

If the children have been given some practice in reading price tags and counting amounts of money from a collection of coins, no other special introduction should be needed for this page. First, let the children discuss

the toys shown on the page and the prices indicated on the price tags. Let them tell about things they have bought with their own money.

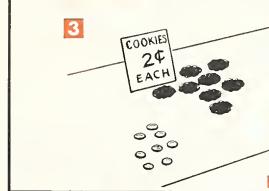
Be sure the children understand that they are to encircle in each of the two strips next to a picture the amount of money indicated on the price tag. If the money shown in a strip is not enough to buy the toy, all the coins in that strip are to be crossed off.

- 1 Direct attention to Picture A. Ask the children how many pennies Don had on the table at first, how many pennies he is putting on the table, and how many pennies he will have in all.
- 2 Tell the children to find the problem that goes with Picture A and write the letter A in the brown response space at the left of the problem. Then have them write the correct numerals on the answer lines.
- 3 Have the children follow the same procedure for each of the other pictures. Be sure to point out that in some of the pictures the children mentioned in the problems are not included.



1

A



3

B



C

D Carol has 7 pennies in all.
She is taking 3 pennies away.
There will be 4 pennies left.

B Tom has 8 pennies.
Each cookie costs 2 pennies.
Tom can buy 4 cookies.

F The ball costs 8 pennies.
Don has 2 pennies on the table.
He needs 6 more pennies.

A Don had 4 cents on the table.

2 Then he put 2 more cents on the table.
Now he has 6 cents on the table.

C Nancy has 3 pennies in each group.
She has 2 groups of pennies.
She has 6 pennies in all.

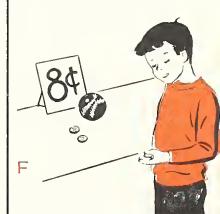
E Ellen is buying the toy umbrella.
She will have 3 pennies left.



D



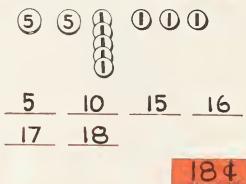
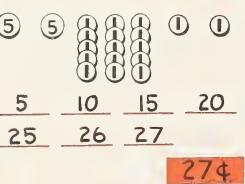
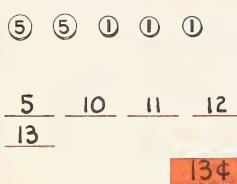
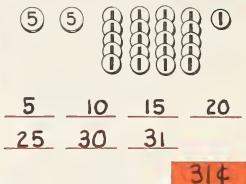
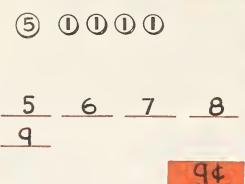
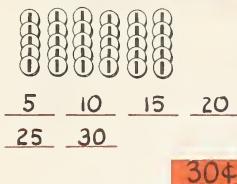
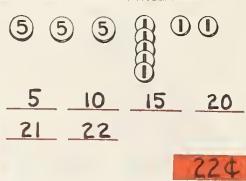
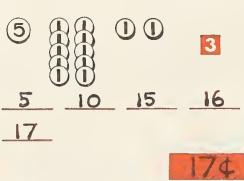
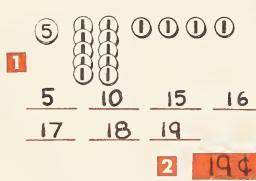
E



F

- 1 Direct attention to the coins and the brown numerals in the first strip. Be sure the children understand that the coins with the numeral 5 on them stand for nickels and the coins with the numeral 1 on them stand for pennies. Point out that the pennies are in groups of 5. Tell the children to count the coins in the top strip by fives. As they count each five, they are to draw a ring around the brown numeral that tells the accumulated value of the coins counted to that point. In the first picture, the children should draw rings around the brown numerals 5, 10, 15, 20, 25, and 30.
- 2 Have the children follow the same procedure for each strip on the page. When they have finished, let them compare and discuss their work.

| | | | | | | | |
|----------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 1 | 5 | 5 | 5 | 5 | 5 | 00000 | 00000 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| 49 | 50 | | | | | | |
| 2 | 00000 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| 49 | 50 | | | | | | |
| 5 | 5 | 5 | 5 | 5 | 5 | 00000 | 00000 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| 49 | 50 | | | | | | |
| 5 | 5 | 5 | 5 | 5 | 5 | 00000 | 00000 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| 49 | 50 | | | | | | |
| 5 | 5 | 5 | 5 | 5 | 5 | 00000 | 00000 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| 49 | 50 | | | | | | |
| 5 | 5 | 5 | 5 | 5 | 5 | 00000 | 00000 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| 49 | 50 | | | | | | |



1 Direct attention to the first picture. Tell the children to count the coins by fives and ones and on the brown lines in the picture write the numerals they would say as they count. In the first picture, they should write 5, 10, 15, 16, 17, 18, 19 on the brown lines.

2 Tell the children to write in the brown answer space the numeral that tells the amount of money shown in the picture. Remind the children to write the cent sign after this numeral.

3 Have the children follow the same procedure for each picture on the page. When they have finished, let them compare and discuss their work.

| | | | |
|--------------|--------------|------------------|---------|
| 2 | 3 | 1 60¢ | 95¢ |
| 65¢ | 50¢ | 50¢ | 95¢ |
| 40¢ | 40¢ | 35¢ | 65¢ |

Other responses
ones shown are
might be given. The
illustrative only.

1 Direct attention to the first picture. Tell the children to count the coins by tens, fives, and ones and write the numeral for the amount in the brown answer space. Remind them that the cent sign must be written after the numeral.

2 Tell the children to draw rings around as many groups of coins worth twenty-five cents as they can. Each coin may be used in only one group.

3 Ask the children to follow the same procedure for each picture on the page. Let the children compare and discuss their work.

92

1 Tell the children to count the coins in the first picture and on the brown lines write the numerals they would say as they count. If the children wish to do so, let them cross off the coins as they count them. In the first picture they should write 25, 30, 40, 50, 55, 56 on the brown lines.

2 Have the children write in the brown answer space the numeral that tells the total amount of money shown in the picture. Remind them to write the cent sign after this numeral.

3 Have the children follow the same procedure for each picture on the page. Let them compare and discuss their answers.

| | | | |
|---|---|--|---|
| | | | |
| 1 25 30 40 50 55 56 2 56¢ | 3 10 20 30 35 40 41 41¢ | 25 30 31 32 33 33¢ | 25 30 35 40 41 42 42¢ |
| | | | |
| 25 30 40 50 60 70 70¢ | 10 15 20 21 22 22¢ | 25 30 40 45 50 55 55¢ | 25 30 35 36 37 38 38¢ |
| 10 5 1 1 1 1 10 15 16 17 18 19 19¢ | 25 5 10 5 5 25 30 40 50 60 61 61¢ | 25 1 1 1 1 25 26 27 28 29 29¢ | 10 10 10 1 1 1 10 20 30 31 32 33 33¢ |

93

1 Tell the children to pretend that they are going to buy the doll cradle in the first brown picture. Ask how much it costs. Point out the two pictures of coins next to the picture of the cradle. In the top strip of coins, tell the children to draw a ring around the coins they would use to buy the cradle. Then tell them to draw a ring around the coins they would use in the bottom strip.

2 Have the children follow the same procedure for each exercise on the page. Tell them to cross off all the coins if a picture does not show enough money to buy the toy.

3 Let the children compare and discuss their answers.

| | | | |
|--|----------------|--|--|
| | 34¢ | | 42¢ |
| | 78¢ | | 61¢ |
| | 27¢ | | 55¢ |
| | 99¢ | | 86¢ |
| | | | <small>Other red lines might be given. The blue lines are illustrative only.</small> |

94-95 FRACTIONS (ONE HALF, ONE FOURTH)

Objectives

Many children use the terms one half and one fourth without any clear understanding of what these terms really mean. (Even adults will sometimes use the phrase "the bigger half"!) But in Grade Two, children can begin to develop a more precise idea of what is meant when we say "one half" or "one fourth."

At this level the presentation of fractions is limited to the following three ideas: first, a whole is present or can be imagined; second, this whole is thought of as separated into a certain number of equal parts; third, attention is focused on one or more of these equal parts. Children need experience with these three ideas before they can develop the concept that a fraction is a number that is associated with a certain part of a whole. The symbols $\frac{1}{2}$ and $\frac{1}{4}$ should not be introduced, and no attempt should be made to compute with fractions.

Preliminary Teaching

Before the children use Worksheets 94 and 95, they should learn that when something is divided into two equal parts, we can use the term one half to tell how much of the original one of these parts is; and that when something is divided into four equal parts, we can use the term one fourth to tell how much of the original one of these parts is.

In this work with fractions, you will find that a flannel board is extremely useful. To make one, cover a sheet of fairly heavy cardboard (any size you wish) with flannel. You can make cutouts to use on the board from felt, construction paper, or light cardboard. Felt cutouts will stick to the board without further preparation. If you use paper or cardboard, glue a small strip of coarse sandpaper to the

back of each cutout. Slight downward pressure will make these cutouts stick to the flannel board.

Prepare a quantity of cutouts in shapes that suggest apples, pies, circles, squares, etc. Leave a few of the cutouts whole. Divide some of the others into two equal parts and some into four equal parts. Give each child a number of the squares, circles, etc.

Since it is hard for children to cut on a straight pencil line, it is best to teach them how to fold and tear paper before you begin actual teaching procedures. Show them how and work with them until you are sure they can do it accurately. Direct the children to take one piece of paper and fold it in two equal parts. Fold a piece of paper yourself to show how the corners and outside edges must match exactly. After the children have folded their papers, show them how to press in a sharp crease with their thumbnails. Demonstrate how to open the paper, place it with the ridge of the crease upward, then hold one side down on the desk, and gently pull the other side away until the paper begins to tear on the crease. The tear then can be finished quickly and accurately. Let the children practice on several sheets of paper.

Explain that when a whole object is separated into two parts so that both pieces are the same size, we say each part is one half of the original object. That is the way we tell how much we have. Demonstrate with several pieces of paper of different shapes. After you have divided several into two equal parts, divide one piece into two parts that are not equal. Ask the children how much each of the unequal pieces is. They should recognize that it is not one half, and be able to tell why. Try to get them to say "Because the pieces

are not the same size" or "Because one piece is bigger (or smaller) than the other."

Now provide the children with strips of colored paper of various sizes. Have them work in pairs or groups, and let them crease and tear strips of paper into two equal parts. Try to get them to be critical about having the parts the same in size, and encourage them to discuss each other's work. If you wish, several shapes that can be divided easily into two equal parts in only one way may be included (hearts, kites, for example). Get the children to see that if they fold and tear these shapes in such a way that both parts are not exactly the same, then neither part is one half of the original. Let the children verify their results by putting the two parts together to see if they are the same.

On a table or desk, pile all the cutouts you made for the flannel board that can be viewed as "one half of the original." Put all the parts of the apples in one pile, all the parts of squares in another, and so forth. Give the children directions such as the following: "John, use some of these parts of apples to make an apple on the flannel board. [John should select two pieces that can be put together on the board to make a representation of a complete apple. Have him point to one of the parts and say 'This part is one half of the whole apple.] Mary, put half an apple on the flannel board. Joe, find the other half of the apple Mary used and put it on the board." Occasionally have a child put a whole cutout on the flannel board. Then have two other children find the two parts of a like cutout and use them to make a replica of the first cutout on the flannel board.

Next, explain what is meant when we speak of fourths. Show how a

iece of paper can be divided into four pieces so that all the pieces are the same size. Let the children practice creasing and tearing papers in the shape of squares, circles, and rectangles into four equal parts. Have them criticize and discuss each other's work. Now divide a number of shapes into four pieces, some of which are the same size and some of which are not. Be sure the children recognize the difference between parts that can be described as fourths and four unequal pieces. Give them a new collection of paper shapes to practice with. You may wish to include some that they cannot easily divide into four equal parts. Let them show each other which pieces can be easily divided into four equal parts and which cannot. Let them try to explain why.

You may also use the flannel board activity for representing fourths. This

time use all the shapes that have been divided into four parts.

Finally, mix up cutouts for the flannel board so that there are some that can be described as halves, some as fourths, and some pieces that can be called neither halves nor fourths. Let one child select a piece and put it on the board; then let other children find the pieces that "go with it" and put them on the board to complete the shape. When the shape is complete, discuss whether the size of the pieces used can be described by the words "half" or "fourth" or neither.

[Worksheets 94 and 95 can be used at this point.]

94 Comments

On this page the child recognizes when he can describe size by the words "half" and "fourth."

94

Point out that in the pictures at the left of the heavy line, each shape is divided into two parts. Tell the children to look at each shape and decide whether the two parts are the same size or not. If the two parts are the same size, the children are to make an X in the brown response space under the shape. If they are not, the children are to make a scribble mark (≡) in the response space.

Point out that in the pictures at the right of the heavy line, each shape is divided into four parts. Tell the children to look at each shape and decide whether the parts are all the same size or not. If they are, the children should make an X in the response space under the shape. If they are not, the children should make a scribble mark in the space.

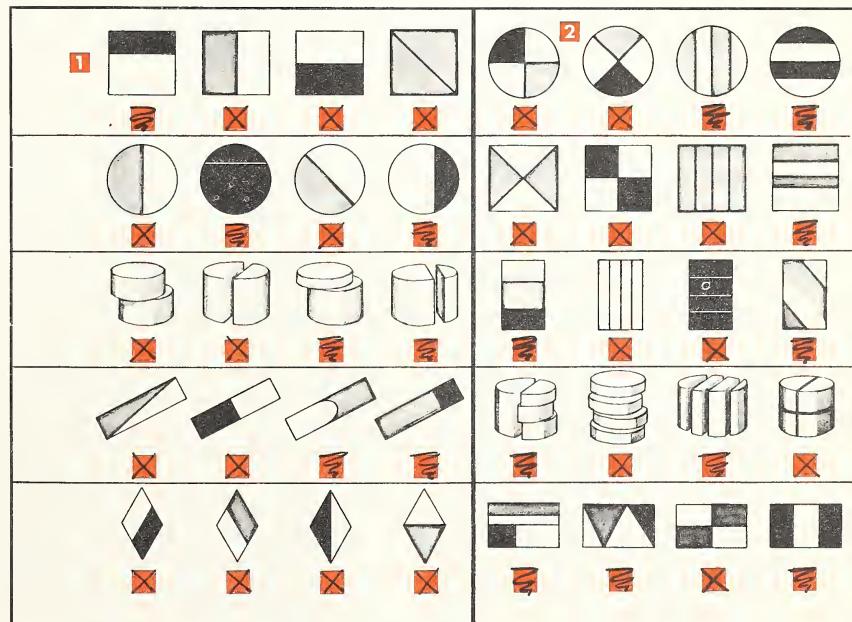
If the activities suggested in the "Preliminary Teaching" section for this page have been used, no special introduction should be needed.

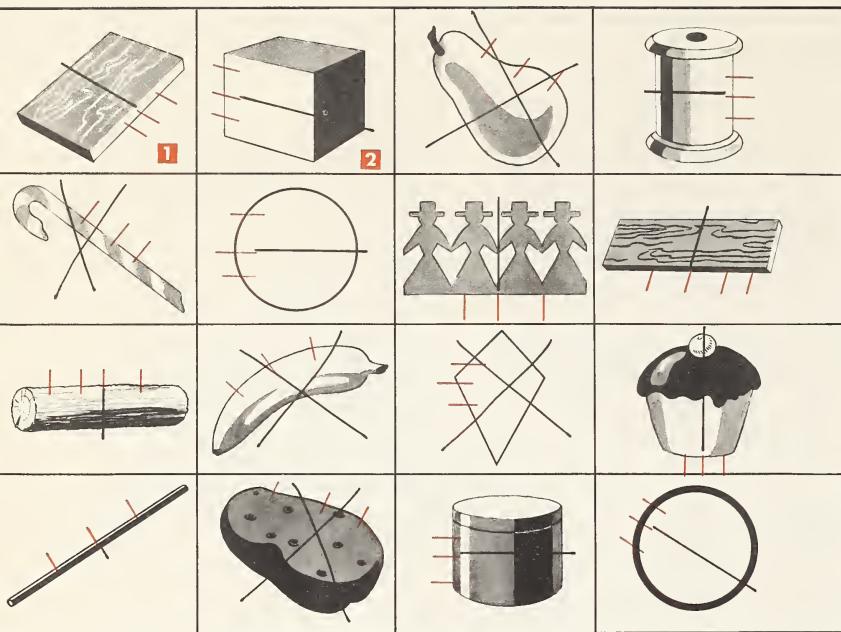
You may need to remind the children that the response mark X means "Yes," and the mark ≡ means "No" or "Cannot tell."

95 Comments

On this page the child practices dividing pictured objects into two equal parts when it is not difficult to do so, and learns to decide when it is very difficult.

If the activities suggested in "Preliminary Teaching" for this page have been used, no special introduction will be needed.





1 Direct attention to the first picture. Tell the children to look at the little brown lines and decide whether one of them shows where the board could be cut so that the size of each part would be $\frac{1}{2}$ of the original. If one line shows this, they are to finish drawing that line across the board. If none of the lines shows where the board could be cut so the size would be indicated by "one half," they are to cross off the whole picture.

2 Have the children follow the same procedure for each picture. Let them compare and discuss their work when they have finished the work on the page.

96-105 THE GROUP OF 9

Objectives

The group of 9 is noteworthy because it is the only group represented by an odd number smaller than 10 that can be separated into equal subgroups. The group of 9 can be separated into 3 groups of 3 each; hence this group has one division fact. There is, of course, a corresponding multiplication fact, 3 threes equal 9.

Apart from these special features and its larger size, the group of 9 is no different from the groups of 3, 5, and 7. Consequently, the same sequence of learning experiences may be followed. The ideas of combining action and separating action should by now be so familiar that the presentation of the group of 9 can be condensed somewhat. There are new basic facts to be learned, but there

are no new fundamental ideas that need to be introduced along with these facts.

Preliminary Teaching

Before the children use Worksheets 96-105, they should be able to combine two subgroups to make a group of 9; to separate a group of 9 into two subgroups; to solve problems that involve comparison by subtraction and problems that involve the "how many more are needed" idea; to bring together equal groups to make a group of 9; and to separate a group of 9 into equal groups.

The activities used to teach the addition basic facts for the group of 6 may be used to teach the addition basic facts for the group of 9. Give each child 9 markers and adapt the activities suggested on page 48 of this Teaching Guide.

[Worksheet 96 can be used at this point.]

You may adapt to the group of 9 the activities suggested on pages 23-24 of this Teaching Guide for teaching the subtraction basic facts for the group of 7. Be sure the child has adequate experience in discriminating between subtracting to find a remainder and subtracting to find how many more (or how many fewer) there are in one group than in another. The children will need 18 markers each for these activities, 9 of one kind and 9 of another.

[Worksheets 97 and 98 can be used at this point.]

Review the "how many more are needed" type of problem with the children. Use facts from the groups of 3, 5, 6, 7, 8, and 9, but emphasize facts from the group of 9. The type of activity suggested in the "Pre-

"Preliminary Teaching" section for pages 59-63 (see page 73 of this Teaching Guide) should be adapted for use here.

[Worksheets 99 and 100 can be used at this point.]

To show 3 threes combined to make a group of 9, use the type of activity suggested in the "Preliminary Teaching" section for page 44 (see page 49 of this Teaching Guide). And to show the separation of a group of 9 into 3 groups of 3, adapt the type of activity suggested in the "Preliminary Teaching" section for page 45 (see page 50 of this Teaching Guide).

[Worksheet 101 can be used at this point.]

Worksheets 102-105 provide practice in using ideas, vocabulary, and basic facts taught up to this point. Counting money, problems of the "how many more are needed" type, and liquid measure are also reviewed. No preliminary teaching should be needed for these pages.

[Worksheets 102-105 can be used at this point.]

96 Comments

On this page the child learns the addition basic facts for the group of 9.

This page is like page 64, except that it deals with the group of 9. For each white picture, the children are to make the appropriate response. See the keyed notes on page 106.

Answers for this page may be verified by using a transparent overlay.

97 Comments

On this page the child learns the subtraction basic facts for the group of 9, and solves problems involving comparison by subtraction. Facts from the group of 9 are used.

This page is like page 65, except that it deals with the group of 9. The

"Comments" for page 65 (see page 78 of this Teaching Guide) apply also to page 97.

When the exercises have been completed, let the children compare and discuss their responses.

98 Comments

On this page the child learns to use symbols to express the addition and subtraction basic facts for the group of 9. He associates the symbolism with addition and subtraction situations shown in pictures.

This page is like page 66, except that it deals with the group of 9. The "Comments" for page 66 (see page 78 of this Teaching Guide) apply also to page 98.

A transparent overlay can be used to verify this page. Be sure the responses are placed so that they do not obscure the children's answers.

99 Comments

On this page the child practices the "how many more are needed" type of problem. He uses basic facts for the group of 9.

This page is like page 59, except that it deals with the group of 9. The "Comments" for page 59 (see page 74 of this Teaching Guide) apply also to page 99.

When the children have finished their work, let them compare and discuss their responses.

100 Comments

On this page the child continues to work with "how many more are needed" problems.

This page is like page 61, except for its emphasis on the group of 9. The "Comments" for page 61 (see page 74 of this Teaching Guide) also apply to page 100.

When the children have finished their work, let them compare and discuss their responses.

101 Comments

On this page the child learns that 3 threes equal 9 and that a group of 9 may be separated into 3 groups of 3. The child also gets more practice with some of the multiplication and division ideas introduced earlier.

This page combines the type of exercises used on pages 69-71. The "Comments" for pages 69-71 (see page 79 of this Teaching Guide) apply also to page 101.

When the exercises on this page have been completed, let the children compare and discuss their responses.

102 Comments

On this page the child distinguishes between "plus" as associated with additive action and "minus" as associated with subtractive action. He also symbolizes the action shown in the picture, and its result, by writing the appropriate basic fact.

This page is like page 72, except that it deals with the group of 9. The "Comments" for page 72 (see page 79 of this Teaching Guide) apply also to page 102.

A transparent overlay can be used to verify this page.

103 Comments

On this page the child practices the addition and subtraction basic facts for the groups of 3, 5, 6, 7, 8, and 9.

No preliminary teaching is needed for this page, but make sure the children understand what they are to do with each set of exercises.

A transparent overlay may be used to verify this page. If you wish, the

answers may be read slowly, and each child can then verify his own work.

104 Comments

On this page the child interprets pictorial problem situations and uses his knowledge of symbolism and basic facts to find solutions.

Let the children examine the page and talk about the objects shown in the pictures. Point out that both the pictures and the problems are lettered in blue, and explain that Problem A and Picture A belong together because they are about the same thing. There is a picture for each problem on the page.

When the children have completed the work for all the pictures and problems, let them discuss and compare their responses.

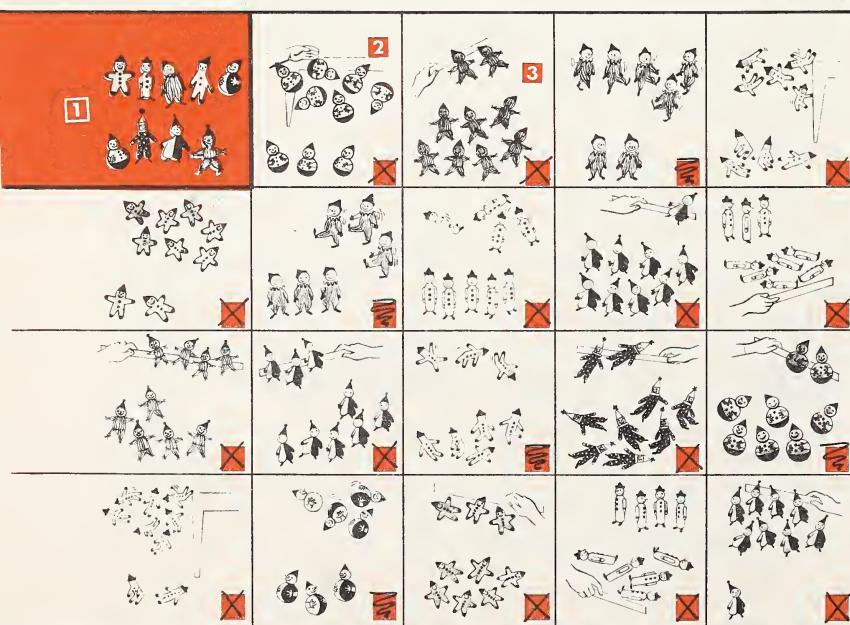
105 Comments

On this page the child continues to solve problems. These pictorial problem situations involve money, measurement, and the "how many more are needed" type of problem.

When you introduce this page, be sure the children notice that Problem A belongs with Picture A, Problem B with Picture B, etc.

Let the children compare and discuss their responses when they have completed the work on the page.

96



1 Direct attention to the picture with the brown background. Get the children to observe that it shows a group of 9 clowns.

2 Tell the children to look at the next picture and decide whether or not it will show a group of 9 when the action has been completed. If it will show a group of 9, they are to make an X in the brown response space. If it will not, they are to make a scribble mark in the response space.

3 Ask the children to follow the same procedure with each of the other pictures on the page.

97

Direct attention to the exercises above the heavy black line. Tell the children to look at each picture and decide how many elephants will be left when the group that is leaving is gone. On the blue line in each picture they are to write the numeral that stands for the number left.

Direct attention to the first exercise below the heavy black line. Tell the children to cross off in the larger group [bears] as many bears as there are wagons in the smaller group. Then on the answer line in the first statement, they are to write the numeral that stands for the number of objects crossed off. Finally they are to decide how many more bears there are than wagons and write the numeral for that number on the answer line in the second statement.

Follow the procedure in Note 2 for the other five pictures.

| | | | |
|--|---|---|----------------------|
| 1 3 elephants left | 7 elephants left | 5 elephants left | 8 elephants left |
| 6 elephants left | 2 elephants left | 4 elephants left | 1 elephant left |
| Subtract 2 bears. 7 more bears than wagons | Subtract 5 stands. 4 more stands than dogs | Subtract 7 balls. 2 more balls than dolls | |
| Subtract 4 stands. 5 more stands than elephants | Subtract 6 balls. 3 more balls than bears | Subtract 3 elephants. 6 more elephants than wagons | |

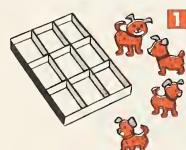
98

Tell the children to look at the first picture and read the expression below the blue answer space. Then they are to decide what to do, and write, in the answer space, the basic fact they would use to find how many more dogs there are than stands. [The children should write $9 - 5 = 4$.] Then have them complete the expression below the answer space by writing the correct numeral on the blue line.

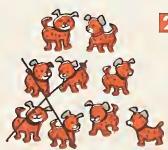
Adapt this procedure for each of the other pictures.

Direct attention to the two columns of exercises. Tell the children to read each exercise and write the answer on the blue line.

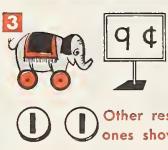
| | | | |
|--|--|--|---|
| 1 $9 - 5 = 4$ 4 more dogs than stands | 2 $9 - 2 = 7$ 7 dogs left | 9 horses in all | A 9-8= <u>1</u> B 6-2= <u>4</u> C 4+4= <u>8</u> D 6+2= <u>8</u> E 9-6= <u>3</u> F 2+6= <u>8</u> G 9-7= <u>2</u> H 3+4= <u>7</u> I 7-2= <u>5</u> J 9-1= <u>8</u> K 3+6= <u>9</u> L 1+7= <u>8</u> M 8-5= <u>3</u> N 4+5= <u>9</u> O 6-1= <u>5</u> P 9-4= <u>5</u> Q 1+8= <u>9</u> |
| 2 $9 - 7 = 2$ 2 more balls than stands | 9 elephants in all | 9 bears in all | A 3-1= <u>2</u> B 7+2= <u>9</u> C 9-5= <u>4</u> D 5+4= <u>9</u> E 9-3= <u>6</u> F 7-6= <u>1</u> G 5+3= <u>8</u> H 4-1= <u>3</u> I 8-7= <u>1</u> J 8+1= <u>9</u> K 8-4= <u>4</u> L 2+7= <u>9</u> M 9-2= <u>7</u> N 2-1= <u>1</u> O 8-6= <u>2</u> P 6+3= <u>9</u> Q 8-1= <u>7</u> |
| 6 $9 - 3 = 6$ 6 more stands than bears | 9 $8 + 1 = 9$ 8 dogs in all | 5 $9 - 4 = 5$ 5 elephants left | |
| 9 $2 + 7 = 9$ 9 dogs in all | 9 $6 + 3 = 9$ 9 bears in all | 8 $9 - 1 = 8$ 8 horses left | |



The box needs 9 dogs in all.
There are 4 dogs.



9 dogs - 4 dogs = 5 dogs
5 more dogs are needed.



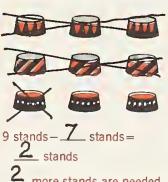
The elephant costs 9 pennies.
There are 2 pennies.



Other responses might be given. The ones shown are illustrative only.
9 pennies - 2 pennies = 7 pennies
7 more pennies are needed.



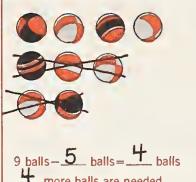
The box needs 9 stands in all.
There are 7 stands.



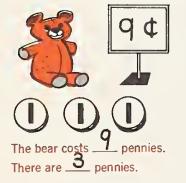
9 stands - 7 stands = 2 stands
2 more stands are needed.



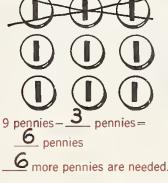
The box needs 9 balls in all.
There are 5 balls.



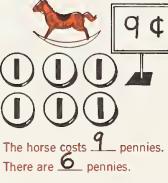
9 balls - 5 balls = 4 balls
4 more balls are needed.



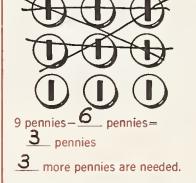
The bear costs 9 pennies.
There are 3 pennies.



9 pennies - 3 pennies = 6 pennies
6 more pennies are needed.



The horse costs 9 pennies.
There are 6 pennies.

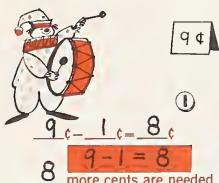


9 pennies - 6 pennies = 3 pennies
3 more pennies are needed.

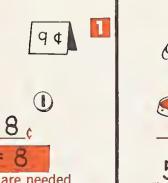
1 Point out the heavy black lines that divide the pictures on the page into pairs. Have the children read the first sentence in the first picture and write the correct numeral on the answer line. Have them do the same with the second sentence.

2 Ask how many dogs are shown in the second picture, and why there are that many. Direct attention to the first sentence. Ask how many dogs should be taken away from the 9 dogs. [4] Tell the children to cross off that many dogs in the picture, write the appropriate numeral on the first answer line, and decide what numeral to write on the second answer line. Then get them to tell what numeral they should use in the second sentence.

3 Use the same procedure for each pair of pictures on the page.

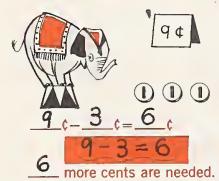


$$8 \text{ more cents are needed.}$$

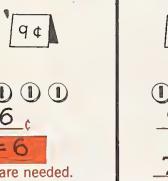


$$9 - 1 = 8$$

| | | |
|---|--------|---------|
| A | $4=2+$ | $4-2=2$ |
| B | $9=1+$ | $9-1=8$ |
| C | $7=4+$ | $7-4=3$ |
| D | $9=6+$ | $9-6=3$ |
| E | $8=2+$ | $8-2=6$ |
| F | $9=4+$ | $9-4=5$ |
| G | $9=8+$ | $9-8=1$ |
| H | $4=1+$ | $4-1=3$ |
| I | $9=2+$ | $9-2=7$ |
| J | $2=1+$ | $2-1=1$ |
| K | $6=3+$ | $6-3=3$ |
| L | $9=5+$ | $9-5=4$ |
| M | $3=2+$ | $3-2=1$ |
| N | $9=3+$ | $9-3=6$ |
| O | $4=3+$ | $4-3=1$ |
| P | $9=7+$ | $9-7=2$ |
| Q | $5=4+$ | $5-4=1$ |

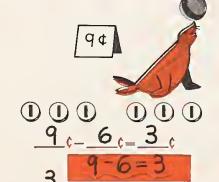


$$6 \text{ more cents are needed.}$$

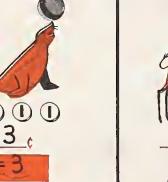


$$9 - 3 = 6$$

| | | |
|---|--------|---------|
| A | $1=1+$ | $1-1=0$ |
| B | $2=1+$ | $2-1=1$ |
| C | $3=2+$ | $3-2=1$ |
| D | $4=3+$ | $4-3=1$ |
| E | $5=4+$ | $5-4=1$ |



$$3 \text{ more cents are needed.}$$



$$9 - 6 = 3$$

| | | |
|---|--------|---------|
| A | $9=5+$ | $9-5=4$ |
| B | $3=2+$ | $3-2=1$ |
| C | $9=3+$ | $9-3=6$ |
| D | $4=3+$ | $4-3=1$ |
| E | $9=7+$ | $9-7=2$ |
| F | $5=4+$ | $5-4=1$ |

1 Work through the first exercise on the page with the children. Have them write the correct numerals on the first three answer lines, write the basic fact in the blue answer space, and complete the final sentence.

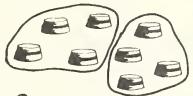
2 The children should complete the other exercises independently.

3 In Exercises A to Q at the right of the page, the children are to write the subtraction basic fact they would use to find the numeral that belongs where the screen is. For Exercise A, they should write "4 - 2 = 2."

101

Tell the children that they are to read the expressions in each picture and use the picture to find the numerals they are to write on the blue answer lines. Point out that some of the pictures show groups that are to be combined, and some show groups that are to be separated.

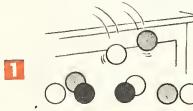
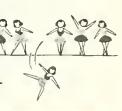
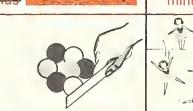
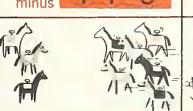
Direct attention to Exercises A to Q at the right of the page. Tell the children to read each exercise and write the answer on the blue line.

| | | | |
|--|---|---|---|
|  |  |  | 2 A 3 threes = <u>9</u> B 6=3 groups of <u>2</u> C 2 fours = <u>8</u> D 9= <u>3</u> threes E 8=4 groups of <u>2</u> F 2 threes = <u>6</u> G 8=2 groups of <u>4</u> H 6= <u>3</u> twos I 6=2 groups of <u>3</u> J 4=2 groups of <u>2</u> K 8= <u>4</u> twos L 2 twos = <u>4</u> M 9=3 groups of <u>3</u> N 8= <u>2</u> fours O 3 twos = <u>6</u> P 4= <u>2</u> twos Q 6= <u>2</u> threes |
| 9 balls in all Put 3 balls in each group. <u>3</u> groups of 3 balls $9 = \underline{3}$ threes 1 <i>Other responses might be given. The ones shown are illustrative only.</i>  2 groups of clowns <u>4</u> clowns in each group <u>8</u> clowns in all 2 fours = <u>8</u> | 8 stands in all Put 4 stands in each group. <u>2</u> groups of 4 stands $8 = \underline{2}$ fours  6 groups of balls <u>2</u> balls in each group <u>8</u> balls in all 4 twos = <u>8</u> | 3 groups of clowns <u>3</u> clowns in each group <u>9</u> clowns in all 3 threes = <u>9</u> | |
|  6 dogs in all Make <u>2</u> equal groups. <u>3</u> dogs in each group $6 = 2$ groups of <u>3</u> |  9 bears in all Make <u>3</u> equal groups. <u>3</u> bears in each group $9 = 3$ groups of <u>3</u> |  8 stands in all. Make <u>4</u> equal groups. <u>2</u> stands in each group $8 = 4$ groups of <u>2</u> | |

102

Get the children to notice that in some pictures a group of objects is being combined with another group and that in other pictures a subgroup is being removed. Direct attention to the first picture. Ask the children to decide whether the action shown suggests "plus" or "minus." Tell them to cross off the word that does not belong with the picture. Now ask how many balls are on the floor, how many balls are falling toward them, and how many there will be in all. Tell the children to write, in the blue answer space, the numerals and signs that tell what is happening. They should write "7 + 2 = 9."

The children should work independently on the other pictures.

| | | | |
|--|--|---|--|
|  1 plus minus $7 + 2 = 9$ |  2 plus minus $4 + 5 = 9$ |  plus minus $9 - 7 = 2$ |  plus minus $9 - 2 = 7$ |
|  plus minus $8 + 1 = 9$ |  plus minus $9 - 5 = 4$ |  plus minus $6 + 3 = 9$ |  plus minus $9 - 3 = 6$ |
|  plus minus $5 + 4 = 9$ |  plus minus $9 - 1 = 8$ |  plus minus $2 + 7 = 9$ |  plus minus $9 - 8 = 1$ |
|  plus minus $9 - 6 = 3$ |  plus minus $3 + 6 = 9$ |  plus minus $9 - 4 = 5$ |  plus minus $9 - 8 = 1$ |

1

A 5 plants plus 2 plants are 7 plants.B 1 box plus 8 boxes is 9 boxes.C 9 cows minus 4 cows are 5 cows.D 5 ducks minus 2 ducks are 3 ducks.E 9 birds minus 1 bird are 8 birds.F 2 dogs plus 7 dogs are 9 dogs.G 4 dolls plus 4 dolls are 8 dolls.H 5 cents plus 4 cents are 9 cents.I 9 plants minus 5 plants are 4 plants.J 8 pigs minus 3 pigs are 5 pigs.K 4 boats plus 5 boats are 9 boats.L 7 balls minus 1 ball are 6 balls.M 9 toys minus 7 toys are 2 toys.N 7 cents plus 2 cents are 9 cents.O 9 cars minus 8 cars are 1 car.P 2 girls plus 2 girls are 4 girls.Q 6 books plus 3 books are 9 books.

A $9 - 7 = \underline{\quad}$

B $9 - 3 = \underline{\quad}$

C $3 + 5 = \underline{\quad}$

D $9 - 2 = \underline{\quad}$

E $3 + 6 = \underline{\quad}$

F $8 - 6 = \underline{\quad}$

G $3 + 4 = \underline{\quad}$

H $7 + 2 = \underline{\quad}$

I $5 - 2 = \underline{\quad}$

J $6 - 3 = \underline{\quad}$

K $8 + 1 = \underline{\quad}$

L $4 + 5 = \underline{\quad}$

M $8 - 3 = \underline{\quad}$

N $7 - 6 = \underline{\quad}$

O $2 + 7 = \underline{\quad}$

P $2 + 3 = \underline{\quad}$

Q $1 + 6 = \underline{\quad}$

A Subtract 4 from 9.

B Add 6 and 2.

C Add 4 and 3.

D Subtract 8 from 9.

E Add 1 and 8.

F Subtract 3 from 6.

G Add 2 and 4.

H Subtract 3 from 8.

I Add 4 and 4.

J Subtract 5 from 8.

K Add 2 and 7.

L Subtract 6 from 9.

M Subtract 2 from 4.

N Subtract 3 from 9.

O Add 3 and 5.

P Add 1 and 7.

Q Subtract 6 from 8.

A $9 - 4 = \underline{\quad}$

B $6 + 2 = \underline{\quad}$

C $4 + 3 = \underline{\quad}$

D $9 - 8 = \underline{\quad}$

E $1 + 8 = \underline{\quad}$

F $6 - 3 = \underline{\quad}$

G $2 + 4 = \underline{\quad}$

H $8 - 3 = \underline{\quad}$

I $4 + 4 = \underline{\quad}$

J $8 - 5 = \underline{\quad}$

K $2 + 7 = \underline{\quad}$

L $9 - 6 = \underline{\quad}$

M $4 - 2 = \underline{\quad}$

N $9 - 3 = \underline{\quad}$

O $3 + 5 = \underline{\quad}$

P $1 + 7 = \underline{\quad}$

Q $8 - 6 = \underline{\quad}$

1 Give separate directions for each column of exercises. You can identify the columns by the color of their letters (blue, gray, and black). In the third column, the children are to write for each exercise, the basic fact that corresponds to the directions given [for Exercise A, $9 - 4 = 5$]. A blue answer line is provided for each exercise. Encourage the children to work independently.



2 $2 + 6 = 8$

A



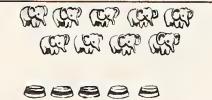
4 + 5 = 9

B



8 - 4 = 4

C



9 - 5 = 4

D

1 A How many bears will there be in all?

$2 \text{ bears plus } \underline{\quad} \text{ bears} = 8 \text{ bears}$

3

B How many balls will there be in all?

$4 \text{ balls plus } \underline{\quad} \text{ balls} = 9 \text{ balls}$

C How many more clowns are there than dogs?

$8 \text{ clowns plus } \underline{\quad} \text{ clowns} = 4 \text{ clowns}$

D How many more elephants are there than stands?

$9 \text{ elephants plus } \underline{\quad} \text{ elephants} = 4 \text{ elephants}$

E How many dolls will be left?

$5 \text{ dolls plus } \underline{\quad} \text{ dolls} = 3 \text{ dolls}$

F How many more horses are there than dolls?

$6 \text{ horses plus } \underline{\quad} \text{ horses} = 2 \text{ horses}$

G How many dogs will there be in all?

$7 \text{ dogs plus } \underline{\quad} \text{ dogs} = 9 \text{ dogs}$

H How many clowns will there be in all?

$6 \text{ clowns plus } \underline{\quad} \text{ clowns} = 9 \text{ clowns}$



E $5 - 2 = 3$



F $6 - 4 = 2$



G $7 + 2 = 9$



H $6 + 3 = 9$

1 Tell the children to read Problem A and then look at Picture A to see what is happening. Direct them to go back to Problem A and decide which word, plus or minus, belongs with the problem. They are to cross off the word that does not belong. Next, they are to write the correct numerals on the answer lines.

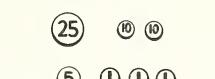
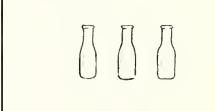
2 Direct attention to the blue answer space in Picture A. In it they are to write the basic fact that shows how to find the answer for Problem A. [They should write "2 + 6 = 8."]

3 If possible, the children should work independently with the other problems and pictures.

105

Tell the children to read all of problem A; then look at Picture A. Ask how much money in all would be needed to buy the two dolls. Have them write the numeral that shows that amount on the first answer line in Problem A. Point out the money that Nancy has in Picture A. Ask where the numeral that shows that amount is to be written. Next, tell them to decide how much more money Nancy needs, and have them write the correct numeral on the third line.

Explain that they are to read each of the other problems and use the picture with the same letter to find the numerals they should write on the answer lines.

| | |
|---|--|
| 1 A The two dolls cost <u>9</u> ¢ in all. Nancy has <u>7</u> ¢. She needs <u>2</u> ¢ more to buy the two dolls. 2 B The two cars cost <u>5</u> ¢ in all. Don has <u>2</u> ¢. He needs <u>3</u> ¢ more to buy the two cars. C The two wagons cost <u>7</u> ¢ in all. Tom has <u>5</u> ¢. He needs <u>2</u> ¢ more. D The two balls cost <u>8</u> ¢ in all. Carol has <u>5</u> ¢. She needs <u>3</u> ¢ more. E The money in Picture E equals <u>53</u> ¢. F The money in Picture F equals <u>67</u> ¢. G Picture G has <u>8</u> pint bottles. You can put <u>4</u> quarts of milk into the bottles in Picture G. H Picture H has <u>3</u> quart bottles. You can put <u>6</u> pints of milk into the bottles in Picture H. |  A  B  C  D  E  F  G  H |
|---|--|

06-118 THE GROUP OF 10

Objectives

The group of 10 plays a central rôle in the system of numeration. So far as the basic facts that belong to this group are concerned, however, there is little to distinguish it from other groups. The sequence of steps used in teaching the basic facts for the other groups should be followed in teaching the basic facts for the group of 10. By now, these steps should be familiar, and they will not be outlined again here.

However, one issue must be discussed. In the first 117 pages of Our Lumber Workshop 2, the basic facts are not shown in the vertical arrangement. Actually, there is no need to write basic facts vertically. The vertical arrangement of numerals is a convenient device for computation,

but vertical arrangement of the basic facts has no special advantages. In Grade Two the emphasis should be on the meaning of addition and subtraction in terms of the actions to which they correspond. Special symbols (+ and -) for the operations of addition and subtraction are used. The various possible arrangements of numerals for computation purposes can best be presented to the children at the time when they are being taught how to compute. Nevertheless, since children may have occasion to see the vertical arrangement of basic facts in published tests or in other materials, they should know how to deal with it. For this reason, on Worksheet 118 the vertical arrangement is taught, and practice in using it is provided.

Preliminary Teaching

Before the children use Worksheets 106-118, they should know how to: combine two subgroups to make a group of 10; separate a group of 10 into two subgroups; use basic facts from the group of 10 in solving problems that involve comparison by subtraction and problems of the "how many more are needed" type; bring together equal groups to make a group of 10; separate a group of 10 into equal groups; and write addition and subtraction basic facts in the vertical form.

The activities used to teach the basic facts for the group of 10 may be exactly like the activities used to teach the basic facts for the other groups the children have studied up to this point. Give each child 10 markers, and adapt the activities suggested previously for combining sub-

groups for the group of 6. (See page 48, of this Teaching Guide.)

[Worksheet 106 can be used at this point.]

To introduce the subtraction basic facts for the group of 10, adapt the activities for the group of 6 suggested previously for teaching subtraction basic facts. (See page 49 of this Teaching Guide for activities that can be adapted.)

[Worksheet 107 can be used at this point.]

When you review comparison by subtraction, give each child 20 markers and go over the "how many more than" situation, using subtraction basic facts from the group of 10. Then provide activities (patterned after those pictured on Worksheet 108) that will require the children to discriminate between subtracting to find a remainder and subtracting to find how many more are in one group than in another. Finally, set up situations that will require the children to discriminate among the three situations shown on page 108 (adding, subtracting to find a remainder, subtracting to find "how many more than"). Use basic facts from the group of 10 for about half of these exercises. For the others, use facts from all the other groups the children have studied.

[Worksheet 108 can be used at this point.]

"How many more are needed" situations should be reviewed with the children. Use basic facts from the group of 10 and also from the other groups they have studied. The type of activity suggested in the "Preliminary Teaching" section for pages 59-63 (see page 73 of this Teaching Guide) may be adapted for use here.

[Worksheets 109 and 110 can be used at this point.]

Before teaching the children that 2 groups of 5 can be combined to make

10, use the type of activity suggested in the "Preliminary Teaching" section for page 44 (see pages 49-50 of this Teaching Guide). You may wish also to review the combining of equal groups to make groups of 4, 6, 8, and 9.

[Worksheet 111 can be used at this point.]

The separating of groups of 4, 6, 8, and 9 into equal groups should be reviewed before taking up the idea that 10 can be separated into 2 groups of 5. Use the type of activity suggested in the "Preliminary Teaching" section for page 45 (see page 50 of this Teaching Guide).

[Worksheet 112 can be used at this point.]

The idea that the number in each group can be found if the total group and the number of equal groups is known, should be reviewed. Special emphasis should be given to the group of 10. Use the type of activities suggested in the "Preliminary Teaching" section for page 71 (see page 78 of this Teaching Guide).

[Worksheet 113 can be used at this point.]

Worksheets 114-117 provide general practice on the various types of problems taught up to this point and on the addition and subtraction basic facts for all groups through 10. Preliminary teaching is not needed.

[Worksheets 114, 115, 116, and 117 can be used at this point.]

To introduce the vertical arrangement for writing basic facts, write " $7+3=10$," " $2+6=8$," and " $3+4=7$ " on the board. Show the children how to write each of these facts in vertical form. Explain that for " $7+3=10$," for example, the 7 is written first and the 3 is written under it. Then a line is drawn under the numerals, and the answer is written under the line. When you rewrite " $7+3=10$," you may, if you wish, put

a plus sign next to the 3, and explain that the sign shows that the new form is read just like the old—"7 plus 3." However, there are good reasons for not using the plus sign in this way, and it is advisable not to use the plus sign in that position again, and not to let the children use it when they use the vertical form.

Repeat this explanation as you rewrite the second fact in vertical form. Tell the children that this is a way of showing addition and subtraction that people sometimes use, and so they should know how to use it. When you rewrite the third fact, have the children tell you where to write each numeral.

Now erase what you have written, and write five or six new addition basic facts, with answers, across the board. Give each child a sheet of paper, and ask as many children to come to the board as there are facts. Tell each child at the board to write one of the facts in vertical form. Tell the other children to write them on their papers. Observe each child to make sure he is working correctly.

Have the children compare their work with the work on the board, and let them discuss any differences that arise. Impress on them that the first numeral in the basic fact must be written first, the second under it, and the answer under a line below the second numeral. Teach the children to read a fact in the vertical form in the same way they read the fact in the equation form—"two plus three equals five," for example. Let each child read one of the examples.

Next, erase the work on the board and write five more addition basic facts, but this time omit the answer after the equals sign. Tell the children to write each fact in the new way.

Now put on the board three subtraction basic facts in equation form. Show the children how to write these

acts in the vertical form. Use the minus sign only once—in the first example. Use the sequence of activities suggested above to teach the children to write subtraction facts in this form and to read them properly. [Worksheet 118 can be used at this point.]

106 Comments

In this page the child learns the addition basic facts for the group of 10.

This page is like page 64, except that it deals with the group of 10. For each white picture, the children are to make the appropriate response. See the keyed notes on page 114.

A transparent overlay may be used to verify this page.

107 Comments

In this page the child learns the subtraction basic facts for the group of 0.

This page is like the upper half of page 65. It deals with "how many are left" situations for the 10 group. If the activities suggested in the "Preliminary Teaching" section for page 07 have been used, no other introduction should be necessary.

A transparent overlay may be used to verify this page.

108 Comments

In this page the child decides upon and writes the addition or subtraction basic fact (for the group of 10) that can be used to solve a pictorial problem situation. The situations in these problems involve comparison by subtraction as well as finding the remainder.

The exercises at the right of the page provide general practice with the addition and subtraction basic facts for all groups through 10. No special introduction should be needed.

A transparent overlay may be used to verify the work on this page.

109 Comments

On this page the child again has experience with the "how many more are needed" type of problem. All these problems are solved by using subtraction basic facts from the group of 10.

This page is like page 59. The children are to read the sentences in each pair of pictures and use the pictures to find the numerals that belong on the answer lines. The "Comments" for page 59 (see page 74 of this Teaching Guide) apply also to page 109.

When the children have finished the work on the page, let them compare and discuss their responses.

110 Comments

On this page the child continues to solve the "how many more are needed" type of problem.

This page is like page 61. The "Comments" for Worksheet 61 (see page 74 of this Teaching Guide) apply also to Worksheet 110.

When the children have completed the work on this page, give them time to compare and discuss their work.

111 Comments

On this page the child learns that 5 twos equal 10 and that 2 fives equal 10. He also reviews the combining of equal groups to make groups of 6, 8, and 9.

This page is like page 69. The "Comments" for page 69 (on page 79 of this Teaching Guide) apply also to page 111.

When the children have finished the work on the page, let them compare and discuss their responses.

112 Comments

On this page the child learns to separate a group of 10 into 5 groups of 2, and into 2 groups of 5. He also reviews the separating of groups of 6, 8, and 9 into equal groups.

This page is like page 70. The "Comments" for page 70 (on page 79 of this Teaching Guide) apply also to page 112.

When the children have finished the work on the page, give them time to compare and discuss their work.

113 Comments

On this page the child learns to separate a group of 10 into a given number of equal groups. He also reviews the separating of groups of 6, 8, and 9 into a given number of equal groups.

This page is like page 71. The "Comments" for page 71 (on page 79 of this Teaching Guide) apply also to page 113.

Let the children have enough time to compare and discuss their responses when they have finished the work on the page.

114 Comments

On this page the child interprets pictorial problem situations by selecting either "plus" or "minus" as corresponding to the action shown. He then writes the basic fact that corresponds to the action and result of the pictured situation. This work is still concerned with the basic facts of the group of 10.

This page is like page 72. The "Comments" for page 72 (on page 79 of this Teaching Guide) apply also to page 114.

A transparent overlay may be used to verify this page.

115 Comments

On this page the child practices the addition and subtraction basic facts for all the groups through 10.

This page is like page 63. The "Comments" for page 63 apply also to page 115.

To check the work on this page, you may wish to read the answers slowly and let each child verify his own work.

116 Comments

On this page the child again interprets pictorial problems by selecting either "plus" or "minus" as corresponding to the action, finding needed data in the picture, and then writing the numerals and signs that symbolize the corresponding mathematical operation.

This page is like page 104. The "Comments" for page 104 (see page 106 of this Teaching Guide) apply also to page 116.

When the children have finished the work on the page, let them compare and discuss their responses.

117 Comments

On this page the child again practices the "how many more are needed" type of problem. He reads the sentences and uses the pictures to find the numerals that belong on the answer lines.

Since the children are familiar with this type of problem, no special introduction should be necessary.

Let the children have time to compare and discuss their responses when they have finished the work on this page.

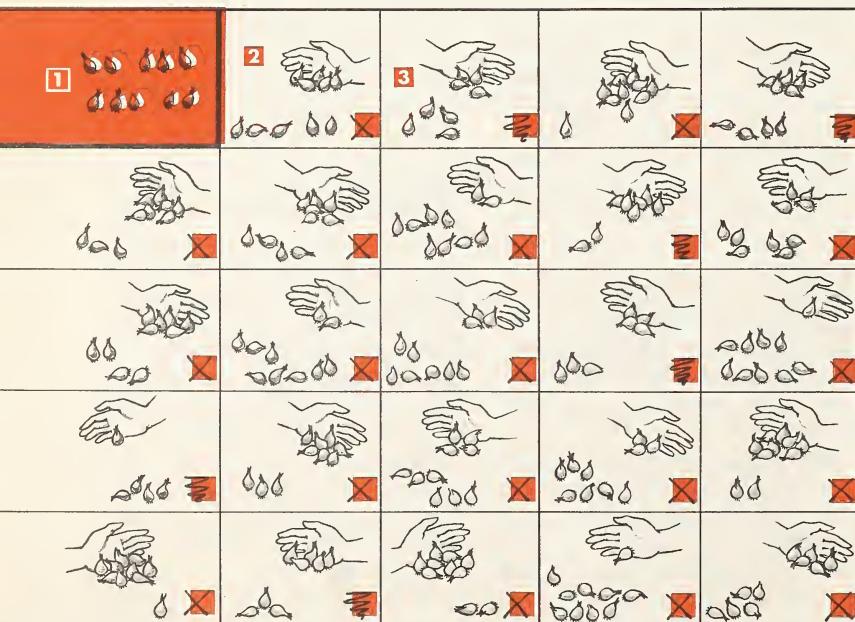
118 Comments

On this page the child learns to write the addition and subtraction basic facts in the vertical form.

If the suggestions made in the "Preliminary Teaching" notes for this page have been followed, no other introduction to the page will be necessary.

It is probably best to verify each child's work yourself.

106



1 Direct attention to the picture with the blue background. Get the children to observe that it shows a group of 10 bulbs.

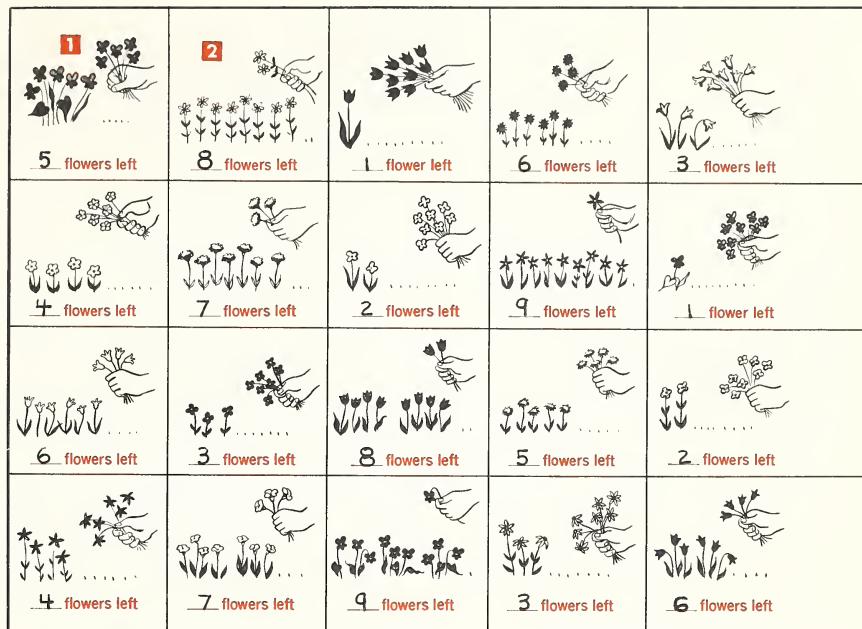
2 Tell the children to look at the next picture and decide whether or not it will show a group of 10 when the action has been completed. If it will show a group of 10, they are to make an X in the blue response space. If it will not, they are to make a scribble mark (≡).

3 Have the children follow the same procedure with the other pictures on the page.

107

Tell the children to look at the first picture and decide how many flowers will be left when the action shown in the picture has been completed. They are to write the numeral that expresses the remainder on the answer line.

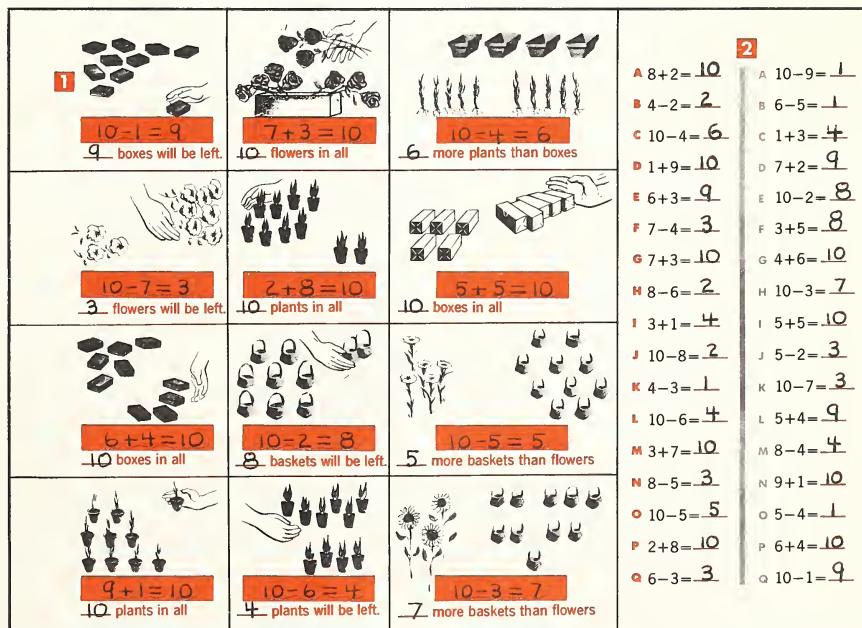
Have the children follow the same procedure for each of the other pictures on the page.



108

Direct attention to the pictures. Let the children to observe that some show groups being combined, some show a subgroup being separated from a larger group, and some show groups that can be compared by subtraction. The basic fact that is used to solve the pictured problem is to be written in the blue space in the picture. The answer to the problem is to be written on the blue answer line in the expression below the blue space.

For each exercise in the two columns on the right-hand side of the page, have the children write the correct numeral on the answer line.



111

Direct attention to the first picture. Ask how many groups of birds shown and how many birds are in each group. Tell the children to read the expression in the picture, and to the picture to find the numeral belongs on each answer line.

Have them follow the same procedure for each of the other pictures on the page.

Tell the children to read each exercise at the right of the page (blue letters A to Q). For each exercise they should write the correct numeral on the blue answer line.

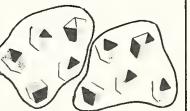
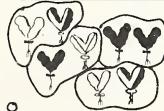
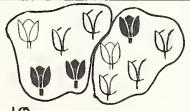
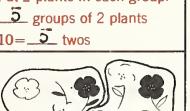
| | | | |
|--|---|---|---|
|  1 5 groups of birds 2 birds in each group 10 birds in all 5 twos = <u>10</u> |  4 4 groups of bees 2 bees in each group 8 bees in all 4 twos = <u>8</u> |  2 2 groups of rabbits 5 rabbits in each group 10 rabbits in all 2 fives = <u>10</u> | 3 A 6 = <u>3</u> twos B 2 twos = <u>4</u> C 2 fives = <u>10</u> D 4 = 2 groups of <u>2</u> E 3 twos = <u>6</u> F 8 = <u>2</u> fours G 9 = 3 groups of <u>3</u> H 4 twos = <u>8</u> I 8 = 2 groups of <u>4</u> J 5 twos = <u>10</u> K 6 = <u>2</u> threes L 2 fours = <u>8</u> M 6 = 2 groups of <u>3</u> N 8 = <u>4</u> twos O 4 = <u>2</u> twos P 8 = 4 groups of <u>2</u> Q 3 threes = <u>9</u> |
|  2 2 groups of bees 3 bees in each group 6 bees in all 2 threes = <u>6</u> |  3 3 groups of rabbits 3 rabbits in each group 9 rabbits in all 3 threes = <u>9</u> |  4 4 groups of birds 2 birds in each group 8 birds in all 4 twos = <u>8</u> | |
|  3 3 groups of birds 3 birds in each group 9 birds in all 3 threes = <u>9</u> |  5 5 groups of rabbits 5 rabbits in each group 10 rabbits in all 2 fives = <u>10</u> |  5 5 groups of bees 2 bees in each group 10 bees in all 5 twos = <u>10</u> | |

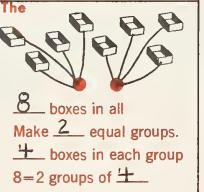
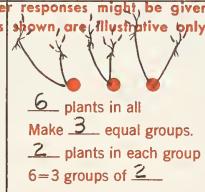
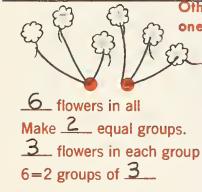
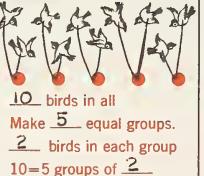
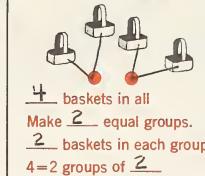
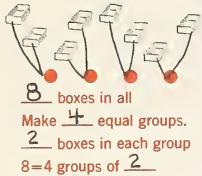
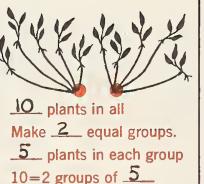
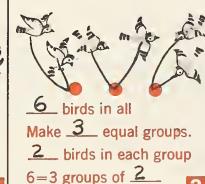
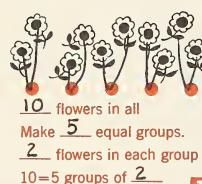
112

Tell the children to read the first expression in the first picture, and to the picture to find the numeral belongs on the answer line. Have them read the second sentence and what it tells them to do. Now have them read the third expression and the numeral that shows the number of groups on the answer line. Finally, have them write the correct numeral on the last answer line.

Have the children follow the procedure for each of the other pictures.

Have the children read each exercise at the right of the page (blue letters A to Q). For each exercise they should write the correct numeral on the blue answer line.

| | | | |
|--|---|--|---|
|  1 10 flowers in all Put 2 flowers in each group. 5 groups of 2 flowers $10 = 5$ twos |  2 9 plants in all Put 3 plants in each group. 3 groups of 3 plants $9 = 3$ threes |  3 10 boxes in all Put 5 boxes in each group. 2 groups of 5 boxes $10 = 2$ fives | 3 A 9 = <u>3</u> threes B 5 twos = <u>10</u> C 8 = 4 groups of <u>2</u> D 2 threes = <u>6</u> E 6 = <u>3</u> twos F 6 = 2 groups of <u>3</u> G 4 twos = <u>8</u> H 10 = <u>2</u> fives I 8 = <u>4</u> twos J 4 = <u>2</u> twos K 6 = 3 groups of <u>2</u> L 8 = <u>2</u> fours M 3 threes = <u>9</u> N 4 = 2 groups of <u>2</u> O 2 fives = <u>10</u> P 9 = 3 groups of <u>3</u> Q 10 = <u>5</u> twos |
|  4 8 plants in all Put 2 plants in each group. 4 groups of 2 plants $8 = 4$ twos |  5 10 flowers in all Put 5 flowers in each group. 2 groups of 5 flowers $10 = 2$ fives |  6 10 plants in all Put 2 plants in each group. 5 groups of 2 plants $10 = 5$ twos | |
|  7 6 flowers in all Put 2 flowers in each group. 3 groups of 2 flowers $6 = 3$ twos |  8 10 boxes in all Put 2 boxes in each group. 5 groups of 2 boxes $10 = 5$ twos |  9 8 flowers in all Put 4 flowers in each group. 2 groups of 4 flowers $8 = 2$ fours | Other responses might be given. The ones shown are illustrative only. |



- A** 2 fours = 8
B 10 = 2 groups of 5
C 6 = 2 threes
D 3 threes = 9
E 10 = 2 fives
F 6 = 3 groups of 2
G 8 = 2 groups of 4
H 2 threes = 6
I 10 = 5 groups of 2
J 2 twos = 4
K 9 = 3 groups of 3
L 2 fives = 10
M 3 twos = 6
N 9 = 3 threes
O 5 twos = 10
P 8 = 4 groups of 2
Q 10 = 5 twos

1 Tell the children to read the first expression and supply the missing numeral. Point out the red dots. Explain that they show the number of equal groups into which the flowers are to be separated. On the answer line in the second sentence, have the children write the numeral that shows the number of equal groups. Have them group the flowers by drawing a line from a flower to a dot, a line from another flower to another dot, and so on, until a flower has been joined to each dot. Then they should repeat the procedure until all the flowers have been joined to dots. Tell the children to read the third and fourth lines and write the numerals that belong on the answer lines.

2 Follow the same procedure for each picture on the page.

3 The children should write the correct numerals on the answer line.



1 Get the children to notice that some pictures show a group of objects being combined with another group while in others a subgroup is being removed. Direct attention to the first picture. Ask the children to decide whether the action shown suggests the word plus or the word minus. Tell them to cross off the word that does not belong. Now ask how many birds there are in all, how many are going away, and how many will be left. Tell the children to write, in the red answer space, the numerals and signs that belong with what is happening [They should write "10 - 3 = 7."]

2 Have the children follow the same procedure for each of the other pictures.

115

Give separate directions for each column of exercises, calling attention to them by the color of their identifying letters (red, gray, and black). In the third column (with black letters), children are to write the basic fact that symbolizes each statement. A blank answer line is provided for each statement. Encourage the children to work independently.

1

- A 7 bees plus 2 bees = 9 bees
- B 9 bags minus 6 bags = 3 bags
- C 5 sticks plus 4 sticks = 9 sticks
- D 10 books minus 5 books = 5 books
- E 10 cows minus 8 cows = 2 cows
- F 3 sleds plus 3 sleds = 6 sleds
- G 6 ducks minus 5 ducks = 1 duck
- H 2 beds plus 8 beds = 10 beds
- I 1 bear plus 6 bears = 7 bears
- J 8 dolls minus 4 dolls = 4 dolls
- K 9 cars minus 2 cars = 7 cars
- L 10 boats minus 3 boats = 7 boats
- M 9 girls minus 8 girls = 1 girl
- N 6 toys plus 4 toys = 10 toys
- O 3 boys plus 7 boys = 10 boys
- P 5 mice minus 2 mice = 3 mice
- Q 8 birds plus 1 bird = 9 birds

- A $8 - 2 = \underline{6}$
- B $10 - 7 = \underline{3}$
- C $2 + 2 = \underline{4}$
- D $6 - 3 = \underline{3}$
- E $3 + 4 = \underline{7}$
- F $7 - 5 = \underline{2}$
- G $10 - 1 = \underline{9}$
- H $3 + 5 = \underline{8}$
- I $5 - 4 = \underline{1}$
- J $9 + 1 = \underline{10}$
- K $5 + 5 = \underline{10}$
- L $3 - 2 = \underline{1}$
- M $2 + 7 = \underline{9}$
- N $10 - 9 = \underline{1}$
- O $7 + 3 = \underline{10}$
- P $8 + 2 = \underline{10}$
- Q $9 - 5 = \underline{4}$

- A Subtract 7 from 8. $8 - 7 = \underline{1}$
- B Add 5 and 2. $5 + 2 = \underline{7}$
- C Subtract 4 from 9. $9 - 4 = \underline{5}$
- D Add 1 and 9. $1 + 9 = \underline{10}$
- E Add 6 and 3. $6 + 3 = \underline{9}$
- F Add 4 and 4. $4 + 4 = \underline{8}$
- G Subtract 6 from 10. $10 - 6 = \underline{4}$
- H Subtract 2 from 6. $6 - 2 = \underline{4}$
- I Add 2 and 3. $2 + 3 = \underline{5}$
- J Subtract 2 from 10. $10 - 2 = \underline{8}$
- K Add 4 and 6. $4 + 6 = \underline{10}$
- L Add 1 and 3. $1 + 3 = \underline{4}$
- M Subtract 2 from 7. $7 - 2 = \underline{5}$
- N Add 4 and 3. $4 + 3 = \underline{7}$
- O Subtract 7 from 9. $9 - 7 = \underline{2}$
- P Add 3 and 6. $3 + 6 = \underline{9}$
- Q Subtract 4 from 10. $10 - 4 = \underline{6}$

116

Tell the children to read the first word in Problem A, and then look at Picture A. Direct them to go back to Problem A and decide which of the two words *plus* or *minus* (in the second word) belongs with the problem. They are to cross off the word that does not belong. Next, tell them to write the numerals that belong on the answer lines.

Tell the children to look at Picture A again and write in the red response space the numerals and signs that correspond to what is happening. They should write "8+2=10."

Have the children repeat these procedures with the other problems and pictures.



2

$$8 + 2 = 10$$

A



$$7 - 2 = 5$$

B



$$10 - 3 = 7$$

C



$$5 - 4 = 1$$

D



3

- A How many boxes will there be in all?
8 boxes plus minus 2 boxes = 10 boxes

3

- B How many more flowers are there than plants?
7 flowers plus minus 2 flowers = 5 flowers

- C How many flowers will be left?
10 flowers plus minus 3 flowers = 7 flowers

- D How many more boxes are there than plants?
5 boxes plus minus 4 boxes = 1 box

- E How many more flowers are there than boxes?
8 flowers plus minus 4 flowers = 4 flowers

- F How many flowers will there be in all?
4 flowers plus minus 2 flowers = 6 flowers

- G How many boxes will be left?
10 boxes plus minus 6 boxes = 4 boxes

- H How many plants will there be in all?
6 plants plus minus 3 plants = 9 plants



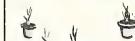
$$8 - 4 = 4$$



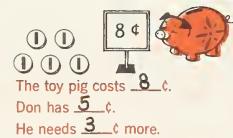
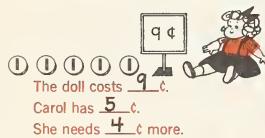
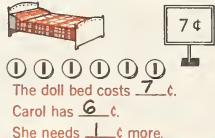
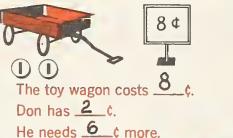
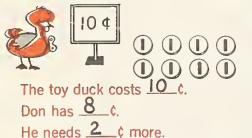
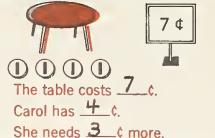
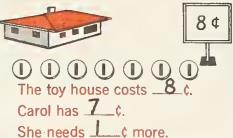
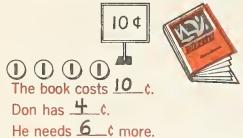
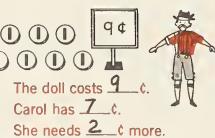
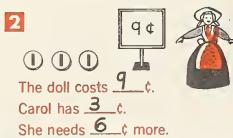
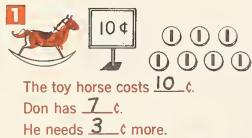
$$4 + 2 = 6$$



$$10 - 6 = 4$$



$$6 + 3 = 9$$



1 Direct attention to the first picture. Be sure the children understand that the price tag tells how much the toy horse costs, and the pennies show the amount of money on hand (the money that Don has). Tell the children to read the problem and use the picture to find the numerals that belong on the answer lines.

2 The children should follow the same procedure for each problem on the page.

| | | | | |
|---------------------|--------------------|------------------|-------------------|------------------|
| 1 A $6+4=10$ | 2 A $4+4=8$ | B $7-3=4$ | C $8-5=3$ | D $5-4=1$ |
| 3 B $4+4=8$ | 4 $6+4=10$ | F $8-2=6$ | G $10-4=6$ | H $9-4=5$ |
| C $7-3=4$ | 5 $10-6=4$ | I $8-2=6$ | J $10-4=6$ | K $9-4=5$ |
| D $8-5=3$ | L $6+1=7$ | M $3+5=8$ | N $4+2=6$ | O $3+3=6$ |

| | | | | |
|-------------------|------------------|------------------|------------------|--------------------|
| A $5-4=1$ | A $5-4=1$ | B $2+3=5$ | C $5-3=2$ | D $9+1=10$ |
| B $2+3=5$ | E $5+4=9$ | F $2+3=5$ | G $5+3=8$ | H $1+10=11$ |
| C $5-3=2$ | G $8+1=9$ | I $2+5=7$ | J $6-2=4$ | K $2+6=8$ |
| D $9+1=10$ | H $9-6=3$ | L $1+8=9$ | M $4-1=3$ | N $10-1=9$ |

| | | | | |
|-------------------|-------------------|-------------------|-------------------|------------------|
| E $5+5=10$ | E $5+5=10$ | F $9-4=5$ | G $8-2=6$ | H $7-2=5$ |
| F $9-4=5$ | I $10-5=5$ | G $10-5=5$ | J $10-2=8$ | K $9-6=3$ |
| G $8+2=10$ | L $10-9=1$ | H $9-5=4$ | M $2+5=7$ | N $6-2=4$ |
| H $7+2=9$ | O $9-8=1$ | I $8-2=6$ | P $8-5=3$ | Q $7-6=1$ |

| | | | | |
|------------------|------------------|------------------|------------------|------------------|
| E $2+5=7$ | E $2+5=7$ | F $6-2=4$ | G $2+6=8$ | H $9-6=3$ |
| F $6-2=4$ | I $7-5=2$ | G $4-2=2$ | J $7-4=3$ | K $8-6=2$ |
| G $2+6=8$ | L $7-7=0$ | H $4-2=2$ | M $1+8=9$ | N $9-8=1$ |
| H $9-6=3$ | O $7-5=2$ | I $0+8=8$ | P $9-8=1$ | Q $8-7=1$ |

| | | | | |
|-------------------|-------------------|------------------|-------------------|------------------|
| I $8-2=6$ | I $8-2=6$ | J $1+1=2$ | K $10-4=6$ | L $6+1=7$ |
| J $1+1=2$ | K $10-4=6$ | L $6+1=7$ | M $1+8=9$ | N $3-2=1$ |
| K $10-4=6$ | N $10-4=6$ | L $7-5=2$ | O $6-1=5$ | P $6-5=1$ |
| L $6+1=7$ | O $6+1=7$ | M $1+8=9$ | P $6-5=1$ | Q $5-2=3$ |

| | | | | |
|------------------|------------------|-------------------|------------------|-------------------|
| I $1+8=9$ | I $1+8=9$ | J $3-2=1$ | K $6-1=5$ | L $7-5=2$ |
| J $3-2=1$ | K $6-1=5$ | L $7-5=2$ | M $4-1=3$ | N $10-1=9$ |
| K $6-1=5$ | L $7-5=2$ | M $4-1=3$ | O $7-3=4$ | P $10-7=3$ |
| L $7-5=2$ | M $4-1=3$ | N $10-1=9$ | O $7-3=4$ | Q $9-6=3$ |

| | | | | |
|------------------|------------------|------------------|------------------|------------------|
| M $3+5=8$ | M $3+5=8$ | N $4+2=6$ | O $3+3=6$ | P $4-2=2$ |
| N $4+2=6$ | P $8-6=2$ | O $6+2=8$ | R $3+3=6$ | S $8-6=2$ |
| O $3+3=6$ | Q $6-4=2$ | P $8-4=4$ | T $3+3=6$ | U $8-4=4$ |
| P $4-2=2$ | R $8-6=2$ | Q $6-4=2$ | S $6+3=9$ | V $8-4=4$ |

| | | | | |
|-------------------|------------------|-------------------|-------------------|------------------|
| M $4-1=3$ | M $4-1=3$ | N $10-1=9$ | O $7-3=4$ | P $3+6=9$ |
| N $10-1=9$ | P $3+6=9$ | Q $9-1=8$ | R $10-7=3$ | S $9-6=3$ |
| O $7-3=4$ | Q $9-1=8$ | T $3+3=6$ | U $10-7=3$ | V $9-6=3$ |
| P $3+6=9$ | S $9-6=3$ | U $10-7=3$ | W $3+3=6$ | X $9-6=3$ |

1 Direct attention to the first basic fact ($6+4=$ _____) and tell the children to write the numeral for the answer on the red answer line.

2 Have the children find the red vertical space that is lettered A and write "6+4=10" in it in the new form. Watch to see that they write 6 first, write 4 under the 6, draw a line under the 4, and write 10 under the line. Do not ask them to write a plus sign beside the 4.

3 Have the children proceed in the same way with each exercise on the page.

119-122 REGROUPING LARGER GROUPS (11 TO 18)

Objectives

Up to this point, the child has been learning the basic facts that arise from groups of 10 or fewer. Eventually he must learn the "higher decade" basic facts, such as $8+7=15$ and $7-9=8$. All of the addition facts with sums up to 18, and the corresponding subtraction facts, must sooner or later be learned to the point of immediate recall.

In the past, children have memorized these facts without ever regrouping actual objects. Thus they have had no help in understanding how the "higher decade" facts relate to what they already know about our system of numeration. And even when objects or pictures were used, the children were usually told to count, rather than to regroup. For example, if a group of 5 and a group of 8 were to be combined, the child was told to start with the group of 8 and continue counting members of the group of 5, saying "nine, ten, eleven, twelve, thirteen." This method did not teach the child to apply the principles of the base-ten system of numeration.

If a group of 8 and a group of 5 were to be combined, the total group may be reorganized into a group of 10 and a group of 3. To the adult, who knows that $8+5=13$, this statement may appear to be obvious and trivial. To the child, who is learning the fact for the first time, it is not so simple. He can be helped to see and understand it by taking two objects from the 5 group and putting them with the group of 8 to make 10. The group of 10 and the group of 3 that remains are then seen as 13. A child should have many such regrouping experiences by which he determines the number of objects in groups of 11 to 18 before he is expected to learn

and remember the higher decade addition basic facts. He should also have experience in determining by means of regrouping (forming one group of 10) the number of objects in the larger groups (11 through 18). He can later use this ability to determine, without "one at a time" counting, the size of the minuend group when he begins to learn the subtraction basic facts for these larger groups.

Preliminary Teaching

Before the children use Worksheets 119-122, they should be able to regroup two groups whose total number is 11 or more so that they can be seen as a group of ones. The child can then recognize, without counting, the numerosness of both the group of 10 and the other group, and he will know that the total is 11, 12, 13, etc., because he sees the groups as 10 and 1 more, 10 and 2 more, etc.

Each child will need 18 small markers. You will need 18 blocks or boxes, large enough so that all the children can see them.

Arrange a pile of 9 blocks and a pile of 5 blocks on the table. By questions and suggestions, get the children to say that there are more than 10 blocks in all, that there are 9 blocks in the larger group and 5 blocks in the smaller group. Ask the children if they can think of a way to find out, without counting, how many blocks there are in all. Take one of the blocks from the group of 5 and put it with the group of 9. Ask the children what you did. Work for the response, "You made a group of 10." Ask how many blocks there are besides the 10 blocks, and how many blocks there are in all. Develop the idea that we know there are 14 blocks because there is a group of 10 and 4

ones. Repeat this activity several times with groups of blocks that total from 11 to 18.

Next, have the children repeat the activity, this time using markers at their desks. Give such directions as: "Make a group of 7 markers and a group of 6 markers. Using just those two groups of markers, make a group of 10. What do you have now? [A group of 10 and a group of 3.] How many markers do you have in all? [13, because there are 10 and 3 more]" Repeat this activity many times, using combinations of groups of 9 or fewer.

[Worksheets 119 and 120 can be used at this point.]

Next use unorganized groups of objects (11 to 18), and let the children take turns showing how they would isolate a group of 10 and then determine how many objects there are in all. If possible, have the children repeat this activity with markers on their desks.

[Worksheets 121 and 122 can be used at this point.]

119 Comments

On this page the child regroups two groups whose total number is from 11 to 18 so that one group contains 10 objects. He then determines the total number of objects by recognizing the group of 10 and the group of ones. He does this without counting.

If the activities suggested in the "Preliminary Teaching" notes for this page have been used, the only introduction necessary is an explanation of what the children are to do with the page.

120 Comments

On this page the child continues to regroup two groups whose total number is from 11 to 18 so that one group

contains 10 objects and the other group the remaining ones.

This page is exactly like page 119. The "Comments" for page 119 (on the previous page) apply also to page 120.

122 Comments

On this page the child continues to regroup an unorganized collection of 11 to 18 objects into a group of 10 and a group of ones.

121 Comments

On this page the child regroups a collection of 11 to 18 objects into a group of 10 and single objects. He can then determine the number of objects in the group without counting.

These exercises are similar to those on the two previous pages, except that the children make a group of 10 and a group of ones from a single unorganized group instead of from two groups. If the activities suggested in the "Preliminary Teaching" section have been used, no other special introduction should be necessary.

119

| | | | |
|---|---|---|---|
| <p>7 apples 9 apples 1 10 apples 6 apples 2 16 apples in all 3</p> | <p>6 cookies 6 cookies 4 10 cookies 2 cookies 12 cookies in all</p> | <p>8 oranges 7 oranges 5 10 oranges 5 oranges 15 oranges in all</p> | <p>6 cookies 8 cookies 6 10 cookies 4 cookies 14 cookies in all</p> |
| <p>8 apples 5 apples 1 10 apples 3 apples 13 apples in all</p> | <p>8 oranges 9 oranges 2 10 oranges 7 oranges 17 oranges in all</p> | <p>6 cookies 8 cookies 6 10 cookies 4 cookies 14 cookies in all</p> | <p>9 apples 9 apples 1 10 apples 8 apples 18 apples in all</p> |
| <p>8 oranges 9 oranges 2 10 oranges 7 oranges 17 oranges in all</p> | <p>Other responses might ones shown are illustrative of given. The 7 cookies 5 cookies 10 cookies 2 cookies 12 cookies in all</p> | <p>8 apples 7 apples 1 10 apples 5 apples 15 apples in all</p> | <p>6 oranges 5 oranges 1 10 oranges 1 orange 11 oranges in all</p> |

1 Ask the children how many black apples there are in the first picture. Tell them to write the numeral for that number on the first red answer line. Ask how many red apples there are, and tell them to write the numeral on the second red answer line.

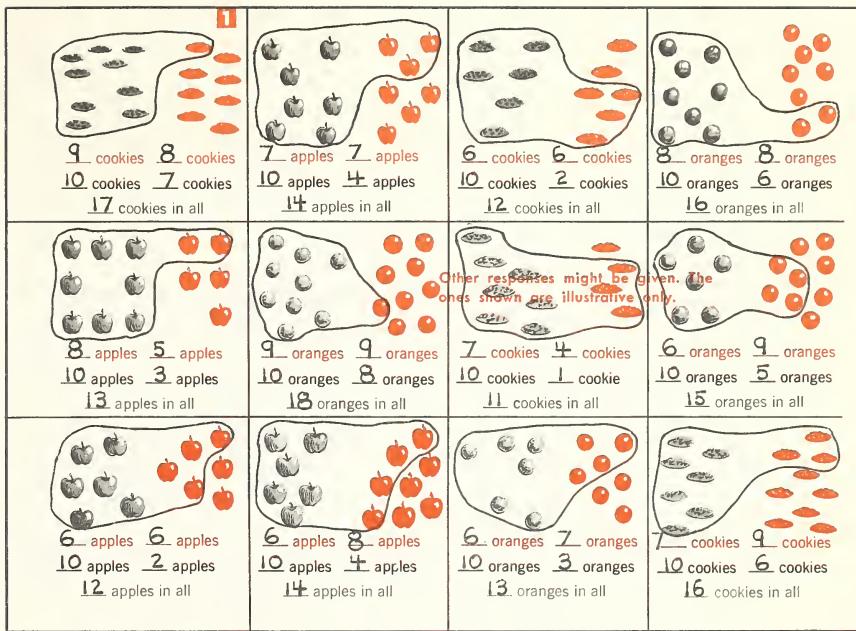
2 Direct the children to draw a ring around all the black apples and enough red apples to make a group of 10 in all. Tell them to write "10" on the first black answer line because there are 10 apples in the ring. Ask how many apples are not in the ring, and tell the children to write the numeral on the second black answer line.

3 Tell the children that the gray answer line is for the numeral that shows the number of apples in all.

4 Have the children follow the same procedure with the other exercises.

120

The following procedure is to be followed for each picture. First, the children are to write on the red answer lines, the numerals that tell how many gray objects and how many red objects there are in the picture. Next, they are to draw a ring around all the gray objects and enough red objects to make a group of 10 and write "10" on the first black answer line, in the second black answer line, they are to write the numeral that tells how many objects are not in the ring. Finally, on the gray answer line, they are to write the numeral that tells how many objects there are in all.



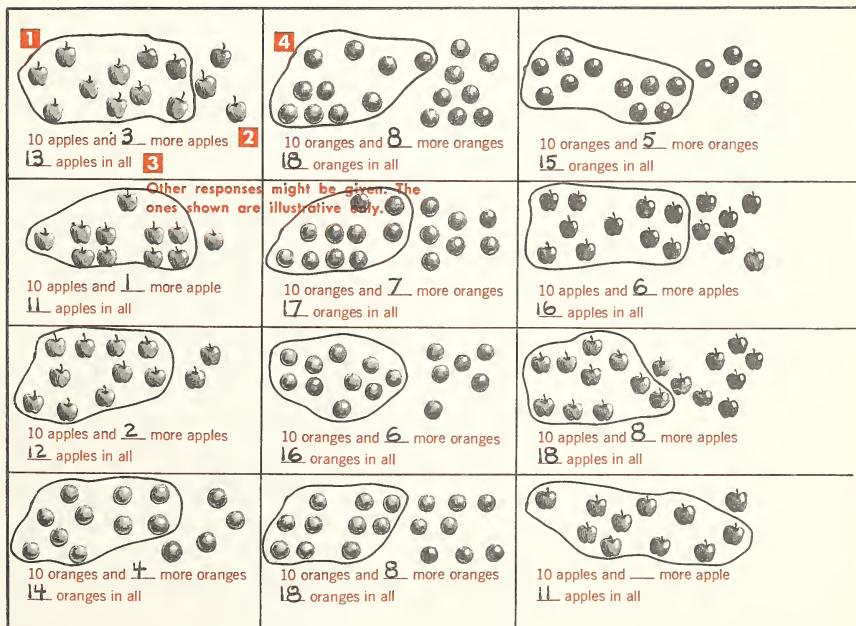
121

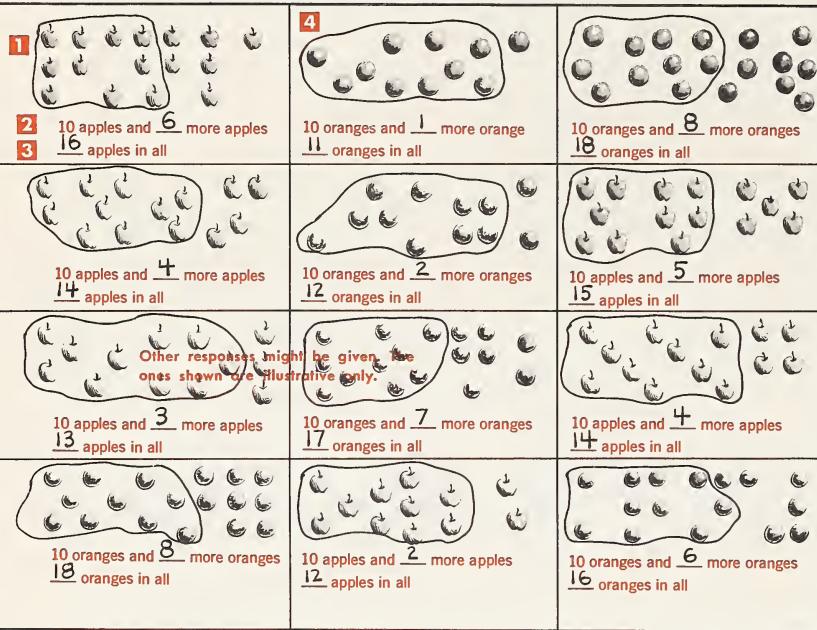
Direct attention to the first picture. Tell the children to draw a ring around a group of 10 apples.

Ask how many apples are left outside the ring. Have the children write the numeral for that number on the first red answer line.

Tell the children to decide how many apples there are in all. They are to write the numeral for that number on the second answer line.

The children should follow the same procedure with the other exercises. They should work independently as much as possible.





1 Direct attention to the first picture. Tell the children to draw a ring around a group of 10 apples.

2 Ask how many apples are left outside the ring. Tell the children to write the numeral for that number on the first red answer line.

3 Ask the children to decide how many apples there are in all. They are to write the numeral for that number on the second red answer line.

4 The children should follow the same procedure with the other exercises. They should work independently as much as possible.

123-128 Review

Objectives

The final section of Our Number Workshop 2 consists of six pages of review. These six worksheets provide further practice on using the concepts and skills developed during the year. They also may be used to evaluate the children's understanding of these ideas and their skill, and to indicate the areas in which individual children need help.

Preliminary Teaching

Since Worksheets 123-128 deal with ideas that have already been introduced, no preliminary teaching is necessary.

Comments

These review pages cover the following: addition basic facts (Worksheet

123); subtraction basic facts (Worksheet 124); equal groups and the base-ten system of numeration (Worksheet 125); measurement and money (Worksheet 126); practice on the vertical form (Worksheet 127). Worksheet 128 is a picture puzzle. The children look for letters hidden in groups of objects, animals, or children, and then write the basic fact that corresponds to the action pictured and the result.

With the exception of Worksheet 128, which is unlike any other page in Our Number Workshop 2, all the exercises follow familiar patterns. You may introduce each page by letting the children examine the page, asking them what they think they are to do, and then letting them discuss briefly the concept dealt with on the page. To use this review section most efficiently, divide the class into small

groups. Then it will be possible for you to observe each child. If the children have trouble with any concepts, they should, ideally, be re-taught at this time. The "Preliminary Teaching" suggestions for the worksheets on which the concepts were introduced may be used for this purpose.

This review will show whether each child is working with a group whose level of achievement is consistent with his own, and it will provide the teacher with useful criteria for planning the work and group placement for the following year.

123

Let the children discover that each picture shows one group joining another group. Tell them that in the red answer space for each picture they are to write the numerals and signs that correspond to what is happening in the picture.

In each of the exercises with red letters (A to H), the children should write on the red line the numeral for e answer.

In each of the exercises with gray letters (A to R), the children should write the numeral for the sum directly under the exercise.

In each of the exercises with black letters (A to Q), the children could write the correct numeral on e red line.

| 1 $2 + 5 = 7$ | $1 + 2 = 3$ | 2 A Add 4 and 3. 7 B 5 cars + 1 car = 6 cars C 4 plus 6 is 10 . D Add 2 and 7. 9 E Add 5 and 4. 9 F 7 dolls + 2 dolls = 9 dolls G 6 plus 3 is 9 . H 2 dogs plus 2 dogs = 4 dogs | 4 A 3+7= 10 B 1+8= 9 C 2+6= 8 D 5+5= 10 E 1+6= 7 F 5+2= 7 G 3+3= 6 H 4+1= 5 I 1+9= 10 J 2+5= 7 K 7+1= 8 L 4+2= 6 M 6+1= 7 N 2+8= 10 O 1+5= 6 P 3+1= 4 Q 3+5= 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| $3 + 5 = 8$ | $2 + 6 = 8$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $3 + 2 = 5$ | $6 + 1 = 7$ | 3 Add <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th> </tr> </thead> <tbody> <tr> <td>2</td><td>1</td><td>7</td><td>3</td><td>4</td><td>6</td> </tr> <tr> <td>3</td><td>3</td><td>8</td><td>10</td><td>5</td><td>2</td> </tr> <tr> <td>4</td><td>7</td><td>10</td><td>9</td><td>9</td><td>8</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table> | A | B | C | D | E | F | 2 | 1 | 7 | 3 | 4 | 6 | 3 | 3 | 8 | 10 | 5 | 2 | 4 | 7 | 10 | 9 | 9 | 8 | | | | | | | | | | | | | 6 Subtract <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>G</th><th>H</th><th>I</th><th>J</th><th>K</th><th>L</th> </tr> </thead> <tbody> <tr> <td>2</td><td>9</td><td>5</td><td>6</td><td>8</td><td>1</td> </tr> <tr> <td>3</td><td>3</td><td>3</td><td>4</td><td>2</td><td>4</td> </tr> <tr> <td>5</td><td>10</td><td>8</td><td>10</td><td>10</td><td>5</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table> | G | H | I | J | K | L | 2 | 9 | 5 | 6 | 8 | 1 | 3 | 3 | 3 | 4 | 2 | 4 | 5 | 10 | 8 | 10 | 10 | 5 | | | | | | | | | | | | |
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| 2 | 1 | 7 | 3 | 4 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3 | 8 | 10 | 5 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 7 | 10 | 9 | 9 | 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 2 | 9 | 5 | 6 | 8 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3 | 3 | 4 | 2 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 10 | 8 | 10 | 10 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| $5 + 5 = 10$ | $4 + 3 = 7$ | M N O P Q R S T U V W X Y Z | 7 8 9 10 11 12 13 14 15 16 17 18 19 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

124

Let the children examine the pictures. They should discover that both the "how many are left" and the "how many more than" types of situations are pictured. In each red answer space they are to write the numerals and signs that correspond to what is happening in the picture.

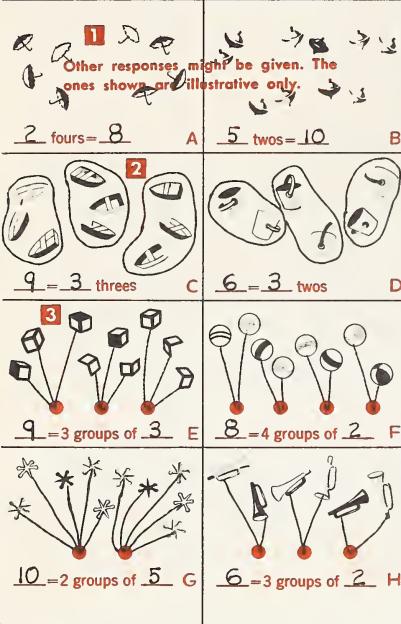
In each of the exercises with red letters (A to H) the children should write on the red line the numeral for e answer.

In each of the exercises with gray letters (A to R), the children should write the numeral for the remainder directly under the exercise.

In each of the exercises with black letters (A to Q), the children could write the correct numeral on e red line.

| 1 $4 - 2 = 2$ | $6 - 1 = 5$ | 2 A 8 birds - 2 birds = 6 birds B Subtract 6 from 10. 4 C 9 minus 1 is 8 . D 7 minus 5 is 2 . E Subtract 1 from 8. 7 F 10 dogs - 5 dogs = 5 dogs G 8 boats - 5 boats = 3 boats H Subtract 6 from 7. 1 | 4 A 3-1= 2 B 8-6= 2 C 10-8= 2 D 9-7= 2 E 6-3= 3 F 4-1= 3 G 8-3= 5 H 10-2= 8 I 9-6= 3 J 6-4= 2 K 2-1= 1 L 5-4= 1 M 8-4= 4 N 10-9= 1 O 10-3= 7 P 5-3= 2 Q 4-2= 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| $10 - 3 = 7$ | $8 - 4 = 4$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $5 - 2 = 3$ | $4 - 2 = 2$ | 3 Subtract <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th> </tr> </thead> <tbody> <tr> <td>9</td><td>8</td><td>6</td><td>4</td><td>9</td><td>10</td> </tr> <tr> <td>5</td><td>7</td><td>2</td><td>3</td><td>3</td><td>4</td> </tr> <tr> <td>4</td><td>1</td><td>4</td><td>1</td><td>6</td><td>6</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table> | A | B | C | D | E | F | 9 | 8 | 6 | 4 | 9 | 10 | 5 | 7 | 2 | 3 | 3 | 4 | 4 | 1 | 4 | 1 | 6 | 6 | | | | | | | | | | | | | 5 Subtract <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>G</th><th>H</th><th>I</th><th>J</th><th>K</th><th>L</th> </tr> </thead> <tbody> <tr> <td>7</td><td>6</td><td>3</td><td>10</td><td>7</td><td>5</td> </tr> <tr> <td>2</td><td>5</td><td>2</td><td>1</td><td>4</td><td>1</td> </tr> <tr> <td>5</td><td>1</td><td>1</td><td>9</td><td>3</td><td>4</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table> | G | H | I | J | K | L | 7 | 6 | 3 | 10 | 7 | 5 | 2 | 5 | 2 | 1 | 4 | 1 | 5 | 1 | 1 | 9 | 3 | 4 | | | | | | | | | | | | |
| A | B | C | D | E | F | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | 8 | 6 | 4 | 9 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 7 | 2 | 3 | 3 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 1 | 4 | 1 | 6 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| G | H | I | J | K | L | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 6 | 3 | 10 | 7 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 5 | 2 | 1 | 4 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 1 | 1 | 9 | 3 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| $5 - 3 = 2$ | $9 - 3 = 6$ | M N O P Q R S T U V W X Y Z | 7 6 5 4 3 2 1 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

125



- 1** Other responses might be given. The ones shown are illustrative only.
- 2** fours = 8 **A** 5 twos = 10 **B**
- 3** 9 = 3 threes **C** 6 = 3 twos **D**
- 4** 9 = 3 threes **E** 6 = 3 twos **F**
- 5** 10 = 2 groups of 5 **G** 6 = 3 groups of 2 **H**
- A** 9 **B** 10 **C** 4 **D** 8 **E** 3 **F** 5 **G** 2 **H** 6
- M** 6 = 2 threes **N** 2 fives = 10 **O** 4 = 2 twos **P** 5 twos = 10
- Q** 6 = 3 threes **R** 8 = 4 twos **S** 3 threes = 9 **T** 8 = 2 fours
- U** 2 twos = 4 **V** 10 = 2 fives **W** 4 twos = 8 **X** 6 = 2 twos **Y** 3 threes = 9

| | | | | | | | | | |
|----------|----|-----------|-----------|-----------|-----------|-----------|------------|-----------|-----------|
| A | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 |
| B | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | |
| C | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 |
| D | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| E | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 |

126

- A** Stick A is just 3 inches long. **1**
- B** Stick B is a little more than 4 inches long.
- C** Stick C is just 2 inches long.
- D** Stick D is a little less than 4 inches long.
- E** Stick E is a little less than 2 inches long.
- F** Stick F is a little more than 2 inches long.
- G** Stick G is a little less than 4 inches long.
- H** Stick H is just 4 inches long.

I Picture I has 7 pints of milk. **2**

J Picture J has 5 quarts of milk.

K Picture K has 4 quarts of milk.

L Picture L has 8 pints of milk.

M Picture M has 22 cents. **3**

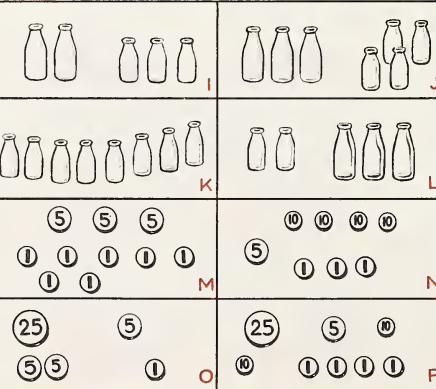
N Picture N has 48 cents.

O Picture O has 41 cents.

P Picture P has 54 cents.

Q Picture P has more money than Picture N.

| | |
|----------|-------|
| A | _____ |
| B | _____ |
| C | _____ |
| D | _____ |
| E | _____ |
| F | _____ |
| G | _____ |



1 For Pictures A and B, have the children write the appropriate numeral on each red line.

2 For Pictures C and D, tell the children to ring the groups indicated by the sentences, and then write the correct numerals in the sentences.

3 For Pictures E, F, G, and H, have the children join objects to dots until there are as many equal groups of objects as dots. Then they are to write the correct numerals on the red lines.

4 Each of the exercises with red letters (A to X) should be made into a correct statement. Sometimes a numeral is to be supplied; sometimes a word must be crossed out.

5 In Rows A to E (gray letters), the children are to write on the red lines numerals that will complete the sequence, beginning with the first numeral in each row.

1 Be sure each child has a ruler. Have the children read Sentence A, measure Stick A, and write the correct numeral on the red line in the sentence. They are to do the same for Sentences B to H.

2 Have the children read Sentence I and look at Picture I. Ask questions that will lead them to decide that they must change the two quarts to pints before they can write the numeral that belongs on the answer line in Sentence I. Have them follow the same procedure with Sentences J to L.

3 The children should complete Sentences M to Q by referring to the appropriate pictures. They should determine what numerals belong on the answer lines in M to P and what letter belongs on the answer line in Q.

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For each exercise identified by red letter (A to Y), tell the children write the numeral for each sum. They should write the numeral directly under the line in each exercise.

For each exercise identified by gray letter (A to Y), tell the children write the numeral for the remainder. They should write the numeral directly under the line in each exercise.

Have the children complete each equation (black letters A to H) by writing the missing numeral on the d line. Then tell them to rewrite in e vertical form each basic fact expressed in the equation. They are to e the red spaces under the equations.

| Add | 1 | Subtract | 2 | | | | | |
|--------------------------|-------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|-------------------------|-------------------------|
| A 4 $\frac{6}{10}$ | B 2 $\frac{5}{7}$ | C 4 $\frac{5}{9}$ | D 1 $\frac{9}{10}$ | E 4 $\frac{2}{6}$ | A 5 $\frac{2}{10}$ | B 10 $\frac{3}{7}$ | C 9 $\frac{8}{1}$ | D 3 $\frac{1}{2}$ |
| F $\frac{5}{7}$ | G $\frac{3}{6}$ | H $\frac{1}{9}$ | I $\frac{3}{5}$ | J $\frac{4}{8}$ | G $\frac{5}{14}$ | H $\frac{4}{2}$ | I $\frac{7}{6}$ | J $\frac{9}{2}$ |
| K $\frac{7}{8}$ | L $\frac{6}{10}$ | M $\frac{2}{9}$ | N $\frac{6}{8}$ | O $\frac{4}{5}$ | K $\frac{9}{3}$ | L $\frac{8}{6}$ | M $\frac{6}{1}$ | N $\frac{5}{4}$ |
| P $\frac{3}{9}$ | Q $\frac{5}{6}$ | R $\frac{1}{6}$ | S $\frac{2}{5}$ | T $\frac{7}{10}$ | P $\frac{9}{7}$ | Q $\frac{4}{3}$ | R $\frac{8}{5}$ | S $\frac{10}{2}$ |
| U $\frac{2}{10}$ | V $\frac{3}{7}$ | W $\frac{2}{3}$ | X $\frac{5}{8}$ | Y $\frac{6}{7}$ | U $\frac{7}{2}$ | V $\frac{8}{5}$ | W $\frac{8}{7}$ | X $\frac{7}{2}$ |

| 3 | A | B | C | D | E | F | G | H | |
|------------------|------------------|------------------|-------------------|------------------|------------------|------------------|------------------|------------------|----------|
| 5-3= | <u>2</u> | 7+2= | <u>9</u> | 1+6= | <u>7</u> | 10-6= | <u>4</u> | 9-5= | <u>4</u> |
| 5 3 — 2 | 7 2 — 9 | 1 6 — 7 | 10 6 — 4 | 9 5 — 4 | 1 2 — 3 | 8 1 — 9 | 8 4 — 4 | 8 4 — 4 | |

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1 A $9-2=7$ C $3+3=6$ E $6-3=3$ G $5-2=3$ I $6-2=4$

2 B $7-2=5$ D $7+2=9$ F $3+4=7$ H $4+2=6$ J $3+2=5$

(Continued from inside front cover)
to make on the worksheets are shown
on the reproduced pages.

The exercises in Our Number Workshop 2 are different from those found in other primary arithmetic workbooks. Our Number Workshop 2 is a laboratory in which the children work with the concepts they have been learning and in which their attention is always kept centered on number ideas. Every exercise makes a positive contribution to the child's cumulative learning. To insure the development of number understandings to the fullest extent, each exercise has been carefully planned with strict adherence to the following criteria:

1 Each exercise gives constructive practice in the number ideas the child has been learning.

2 There is no extraneous material—no activity unconnected with arithmetic, no useless and time-consuming coloring, drawing, or pasting—to distract the child.

3 Individual differences are provided for. The exercises are challenging and interesting to the able children and still are within the abilities of the slow learners. The nature of each worksheet enables the teacher to give directions to groups of differing abilities, to allow a suitable amount of time for doing the work, and to easily evaluate the work of the children.

4 The exercises on all but a few worksheets are so constructed that, when the page has been introduced and the instructions for doing the work have been given, the children will be able to complete the worksheet on their own. The teacher can then give assistance to the less able children.

5 The child must rely on his own judgment and knowledge to do the work. Particular care has been taken to require meaningful answers—not mechanical, or rote, responses.

Provision for Individual Differences

For the children to benefit fully from Our Number Workshop 2, the teacher must be sure that she is using it as it is meant to be used. To take advantage of its adaptability to individual differences, the teacher should work with small groups of children of similar abilities. The teaching that takes place before the use of the exercises is also most effective when the teacher works with reasonably small groups. The exercises were planned so that the children can work independently, thus giving them confidence in their new knowledge and giving the teacher time to work with one group of children without neglecting another group.

An important part of teaching is to adapt the materials to the ability of the child. Our Number Workshop 2 is designed to permit great flexibility in adapting the work to individual differences. For a superior group, the teacher may give two or more directions for doing the work on a worksheet and let the children complete the page independently. For a less able group, she may give one direction at a time, let the children make the responses required for this direction, and then give the direction for the next step.

Our Number Workshop 2 makes possible another type of adaptation to individual differences. The less able groups need not complete in the time available all the work on a worksheet that requires more than one set of responses. The remainder of the work can be done on the following day, or the children can return to it later in the year. Worksheet 8 is an example of a page that can be used for several class sessions.

Response Techniques

In Our Number Workshop 2, the child is required to use the following four

response marks: ● (a filled-in circle) which is used to indicate too much, more, more than enough, etc.; ○ (an open circle), which is used to indicate too few, fewer, not enough, etc., which is used to indicate yes, this etc.; and the scribble mark (☒), which is used to indicate no, not this, cannot tell, etc.

Each of the four response marks has a kinesthetic aspect and a connection with the meaning it expresses. The teacher should make sure these connections are firmly established in the minds of the children. The mark for too few, not enough (○) is open and empty, and easy to make; it requires less physical effort to make than ●, which suggests too much. The mark for more than enough because it is full and takes more time to make. The mark for this one or here, is already familiar through a variety of experiences. The scribble mark (☒) is a natural symbol for no, not this, etc., since children instinctively scribble out words or sentences that we wish to exclude.

On each worksheet on which a child is required to make any of the four response marks or on which he is to respond by writing letters, colored space has been provided for each response. On some worksheets such spaces are provided for writing numerals and basic facts. The teacher can quickly check worksheets on which responses of this type only are made by making, for each worksheet, a transparent overlay that includes the correct responses. On other worksheets, the child is asked to join objects by a line, to draw rings around groups of objects, to mark out words, objects, and sentences, to enclose number words and numerals, to write numerals and signs, to make check marks, or to mark off lengths of a line. All these markings are simple to make, and all are meaningful to the child.

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HARTUNG MAURICE L MAURICE
LESLIE 1902-
OUR NUMBER WORKSHOP
39877370 CURR HIST



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|------------|--------|---------------|
| FEB - 9 | RETURN | RETURN JAN 29 |
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| | | |
| FEB 20 | RETURN | |
| APR 9 | RETURN | |
| | | |
| | | |
| JAN 23 | RETURN | |
| AUG 18 '79 | | |
| OCT 21 | RETURN | |
| | | |
| MAR 18 | RETURN | |
| | | |
| | | |
| AUG 18 '79 | | |
| OCT 10 | RETURN | |
| | | |
| JAN 26 '81 | | |
| | | |
| JUN 1 JRM | | |
| | | |
| | | |

off some of the objects pictured, children's responses will vary. It is not feasible to show all the creative answers, those shown on reproduced pages are typical only. Child's work should be evaluated on his ability to follow directions and to show by his responses he understands the lessons.

The various other types of exercises, specific suggestions for checking made in the teaching notes, the teacher has become familiar with the Workshop, however, she will undoubtedly develop her own methods of evaluation for most of the exercises. Drawing is used as a means of indicating response on Worksheet 8.

Teaching Considerations

The preliminary teaching has been done, as outlined in this Teacher Guide, the procedure for using a worksheet should be somewhat as

acher allows the children to see the page briefly, then directs their attention to the first exercise. She explains what they are to find and how the answers are to be indicated. When the children have done the work for the first exercise, the teacher inspects each child's work and gives assistance to those who need it. The children then finish the work on the page independently.

The only special equipment required for the work in Our Number Workshop 2 is a supply of one-inch sticks, two-inch sticks, and rulers for use in the exercises on linear measurement (Worksheets 50-53 and 126). For all the other worksheets, only soft pencils (or crayons) and markers are needed.

Color is used in a functional, rather than in a merely decorative, way. One type of functional use of color may be observed on Worksheets 11, 41, and 58, on which colored spaces indicate the places where the child is to write his responses. Another functional use of color is illustrated

on Worksheets 10, 19, and 64, on which key objects that are to be matched, combined, or compared with other objects on the worksheet are shown in color or on colored backgrounds.

Whenever possible, the teacher should help the children to discover their errors and to correct their own work. The children should be made to feel that discovering and correcting errors is a part of learning, not a sign of failure.

Only activities that develop number concepts have been used in Our Number Workshop 2; the type of activity in each exercise has been related to a concept. Great care has been taken to keep the responses simple and to avoid all activities that would set up blocks to the learning of arithmetic. While variety has been provided within the framework of the exercises, the number of different types of exercises is small, so that the child uses over and over again techniques with which he is already familiar.

VOCABULARY LIST

This contains the 123 words used in Our Number Workshop 2, for each page, the words that are new on that page. 11 words indicated by asterisks will be familiar to children

who have completed The New Basic Reading Program of the Curriculum Foundation Series through the new Our New Friends (1²). For these children, only 52 words will be new in this book.

| | | | | | | | | | |
|--------|----|------------|----|----------|----------|----------|-------|-----------|-----------|
| eight | 14 | *squirrels | 25 | plants | quarts | tables | 75 | *big | *on |
| *five | 15 | *birds | 28 | add | *all | left | | *little | *now |
| *four | | *chickens | | *books | *baskets | 66 | *be | 77 | *Tom |
| nine | | *kittens | | *from | *in | turtles | | *umbrella | 97 |
| *one | 18 | bottles | | subtract | 57 | bears | 68 | *going | elephants |
| seven | | oranges | 43 | equals | flower | cents | 78 | *playing | stands |
| six | 20 | boxes | | sleds | *wagon | dime | | *Carol | clowns |
| ten | | box | 46 | *ducks | 59 | *a | frogs | 101 | *many |
| *three | | *cans | | groups | *cows | *horses | 88 | *has | *how |
| *two | 21 | *apple | | *of | *for | mice | | *had | 105 |
| *and | 22 | bags | 50 | less | needed | nickels | | taking | *you |
| *are | 23 | *balls | | more | *there | 70 | *put | *cookie | money |
| *dogs | | *boat | 51 | *just | *this | blocks | | costs | picture |
| is | | *boys | | than | 60 | *make | 71 | Don | *milk |
| pigs | | *cars | 52 | inch | *buy | beds | | *Ellen | bees |
| plus | | *dolls | | inches | *pen | *away | | *Nancy | sticks |
| minus | | *girls | | | *it | eating | | *he | |
| ro | | | | | | *running | | *she | |
| | | | | | | to | | *then | |

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